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The Wildlife Investigator Series

SKULLS, ANTLERS, AND HORNS
Understanding the Natural History of Animals

WILDLIFE TREES
The Value of Snags and Down Logs

WILDLIFE BIOLOGISTS
A Day in the Field

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VOLUME 1

JUNE 2004

BLM

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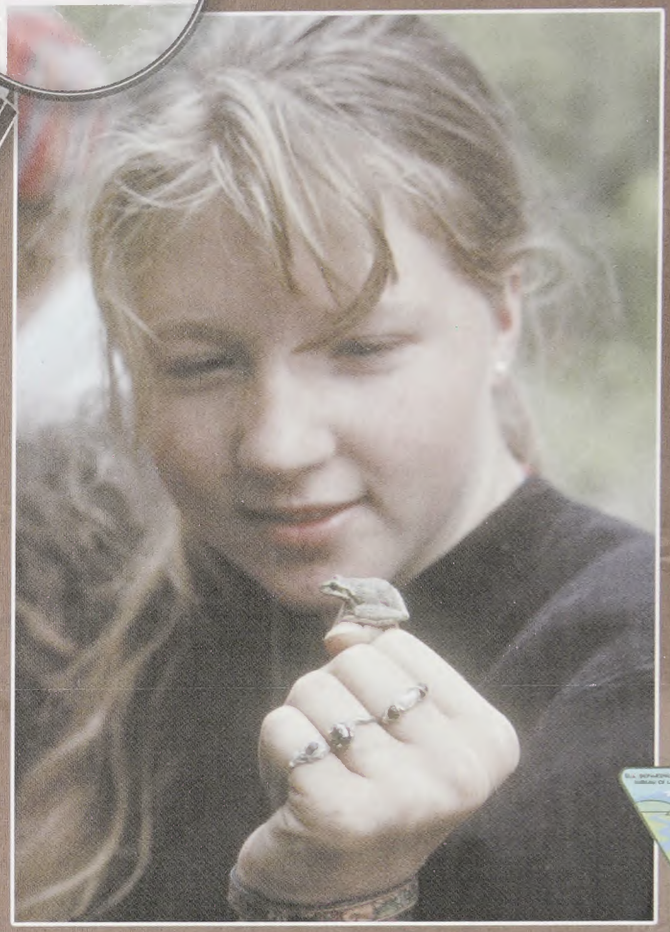

VOLUME 1
JUNE 2004

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Compact Disk . . . . . .inside back cover

Skulls, Antlers, and Horns—Understanding the Natural History of Animals
Images, narration, extension activities, worksheets, poster, and poster key
Wildlife Trees—The Value of Snags and Down Logs
Images, narration, extension activities, poster, and poster key
Wildlife Biologists—A Day in the Field
Images, narration, extension activities, poster, and poster key

Abstract

The Bureau of Land Management and Finger Lakes Community College have developed educational materials to help wildlife biologists and others give presentations on three wildlife topics. *Skulls, Antlers, and Horns—Understanding the Natural History of Animals* explains how characteristics such as teeth, eyes, and skull size can provide clues about the identity of an animal and how it lived. *Wildlife Trees—The Value of Snags and Down Logs* explores the many ways that different wildlife species use both living and dead trees. *Wildlife Biologists—A Day in the Field* discusses wildlife management and what biologists do. Images and narration are provided for presentations at three levels: ninth grade through twelfth grade, fifth grade through eighth grade, and kindergarten through fourth grade. The presentations include "fast facts" to add interesting sidelights to the presentation, enrichment activities to involve the students, and followup activities for presenters and teachers to use after the presentation. The presentation materials are also provided on a CD so they can be customized to meet the needs of each audience and presenter.

Introduction

Children seem to have a natural curiosity about wildlife. From the time they are little, they seek knowledge about different animals and how they live. This quest for knowledge continues through school, where wildlife and habitat topics are commonly taught in classrooms around the world.

Teachers and organizations that teach about wildlife frequently seek additional information or new ways to present information—usually from experts such as wildlife biologists. Wildlife biologists are often called upon to make classroom presentations to supplement lessons on a variety of wildlife topics.

The purpose of the *Wildlife Investigator Series* is to support wildlife experts and others in making wildlife presentations to students. It is intended to provide ready-made presentations, including images and narration, as well as sufficient materials from which to prepare customized presentations. The materials provided in the *Wildlife Investigator Series* greatly reduce the amount of time it takes to prepare a presentation, yet still allow flexibility to build in information pertaining to a specific region or a topic covered in the classroom. While it was designed for wildlife biologists within the Bureau of Land Management (BLM), wildlife experts in other agencies and organizations can easily use the material in the *Wildlife Investigator Series*.

Volume 1 of the series contains tips for presenters, a general overview of BLM, and sections on three wildlife topics: *Skulls, Antlers, and Horns—Understanding the Natural History of Animals, Wildlife Trees—The Value of Snags and Down Logs, and Wildlife Biologists—A Day in the Field*. For each of these topics, there are presentations for ninth through twelfth grade, fifth through eighth grade, and kindergarten through fourth grade. The ninth through twelfth grade presentations are shown first, incorporating both the narration and images. Some or all of these same images can be used for presentations to the other grades and slide numbers have been incorporated into those narrations for easy reference. Each presentation meets specific *National Science Education Standards*, which are listed at the beginning of each topic.

Environmental Education Programs

Each presentation is targeted to a specific audience. Presentations for the youngest students are simple and brief, as their comprehension and attention spans are limited. Presentations for the older age groups are more encompassing. Within each of these presentations, there are "fast facts" that help make the presentations more interesting and "enrichment activities" to get the students involved in the presentations. At the end of each topic, there are age-appropriate activities and handouts that teachers and presenters can use to highlight the concepts covered in the presentations.

In addition to the presentations, there are posters available that support each of the topics in this volume. These posters are interactive—they include an activity that involves the students and increases their retention of the material presented. The posters may be given to teachers to display after the presentation or to small groups of students as part of the presentation. They are most effective if they are given out with some explanation to reinforce the concepts presented. Images of the poster images, as well as keys to the activities they contain, are included at the end of each topic in this volume. The actual posters are available from BLM's Printed Materials Distribution Service.

The material in this volume is intended for use in a computer presentation, though actual slides may be available for loan from some BLM State Offices. The images and narration shown, as well as some additional images, are provided (in Microsoft PowerPoint®*) on the compact disk (CD) at the back of this volume. Presenters can create presentations from the material on the CD and can also add their own material to customize their presentations. Many of the images provided, however, were purchased with a one-time right and can only be used for environmental education purposes as outlined in this publication. They cannot be used in other publications or for personal gain. Anyone wishing to use the images for any other purpose must first contact the photographer and obtain permission. The CD also contains all of the extension activities and worksheets, as well as the poster keys.

The presentations in the *Wildlife Investigator Series* are a valuable resource for wildlife biologists who work for BLM and other Federal or State agencies. These presentations can help educate the public, create a positive impression of wildlife agencies, and perhaps spark a student's interest in pursuing a career in natural resources. By visiting classrooms and interacting with students, wildlife experts have a unique opportunity to help students understand, appreciate, and conserve wildlife species and their habitats.

* The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Federal Government.

Tips for Presenters

Whether this is your first time as a guest speaker or you are a seasoned professional, please take the time to read the suggestions below. They are specifically designed for this series.

1. **Be prepared.** The best suggestion for any teaching situation is to be as ready as possible. Review the images and text several times so your words flow smoothly. Anticipate questions that may arise from the students. Remember that you often speak faster in front of a group than you do during practice, so make a conscious effort to slow your pace. This creates a more relaxed atmosphere for you and the students. However, it is a good idea to have extra material ready (for example, prepare 45 minutes of material for a 30-minute presentation).

2. **Consider the audience.** The pace of your presentation and the terms you use should be appropriate for your audience. Young children have a very short attention span and may not sit through a presentation that is longer than 15 minutes. Perhaps a reasonable goal for presentations to young students would be to provide them with a positive impression of wildlife, the BLM, and wildlife management in general. Older audiences will be able to retain more and understand more complicated concepts. Often a teacher will ask you to give a presentation as part of a unit on wildlife or natural resources. Ask the teacher in advance what topics have already been covered so you can modify your presentation accordingly. It does not hurt to reinforce a topic already covered in the classroom, but it helps you to know that the students are already familiar with the concepts.

3. Use **your strengths**. Each of us brings different skills, knowledge, and experiences to the classroom. One advantage of being a guest speaker is the latitude you have in presenting the material. Humor, genuine excitement for wildlife and management issues, first-hand experiences, and a wealth of knowledge about the subject matter all can be used to create a dynamic presentation. Consider bringing props such as equipment or a field vest or pack to show some of the

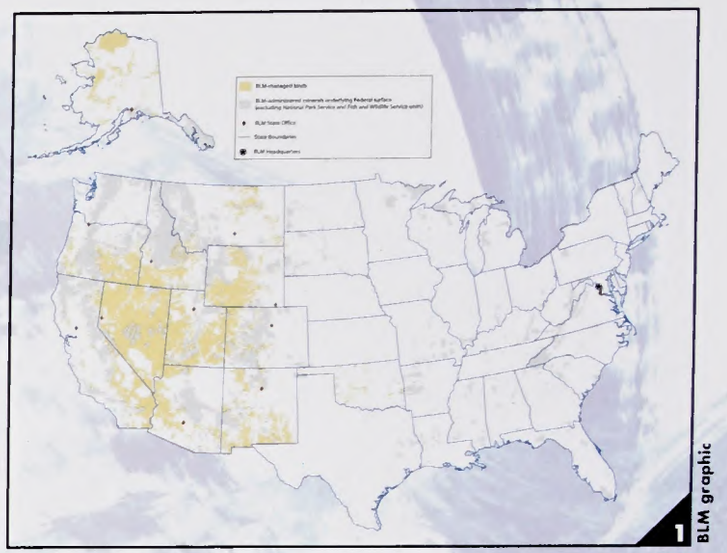
items you use as a biologist or resource manager. Remember that many of the experiences you take for granted are new to the students you are teaching.

4. **Establish the ground rules.** Although actual discipline problems should be few (no promises, though!), your presentation will run more smoothly if you clearly state your preferences to the students on such matters as how you wish to be addressed (Mr., Mrs., Dr., first name, etc.), asking questions (whether students can ask questions during the presentation or should wait until the end), talking to neighbors, and handling your props or equipment. One common mistake guest speakers make is to leave these matters to the classroom teacher. This will work only if the teacher has the same opinion as you on such matters. As a "guest," you may feel the need to defer to the regular teacher. We suggest that most classroom teachers feel that since you are going out of your way to come and speak, it is their duty to make you as comfortable as possible. In addition, remember that the classroom teacher should be called upon immediately if you encounter any situation that you consider a discipline problem. Often a gentle reminder to the student is enough to spark the appropriate action from the teacher (this is the other advantage of being a guest—you do not have to be the bad guy!).

5. **Control the flow of the presentation.** A completely silent class is often an uninvolved group of students, but too many questions are not good either. Feel free to limit questions (using statements such as: "I have time for one more question before I go on" or "Is there anyone who has not yet asked a question and would like to ask one now?" or "I am very glad to see so much interest in this topic, but I think you'll like what we'll be talking about next"). On the other hand, if students are not asking questions, you may consider asking questions of them. If time is running short, it is best to do a good job of presenting what you can rather than quickly racing through everything just to finish.

Overview of the Bureau of Land Management

The Bureau of Land Management, also known as the BLM, is a government agency that manages over 261 million acres of public land. That is about one-eighth of the land in the United States! The BLM also manages 700 million acres of minerals under the surface of the land.



1 BLM graphic

The public lands vary greatly—from rainforests to deserts. They contain mountain peaks over 14,000 feet high, more than 116,000 miles of fishable streams, and many other natural resources. Some resources are renewable, such as forests and grasslands, which means they can grow back or be replaced. Some resources are nonrenewable, such as oil, gas, and minerals, which means they cannot be replaced.

2 © Wayne Mumford

Environmental Education Programs

BLM Photos

3

The public lands are used for a wide range of activities, such as livestock grazing, forestry, mining, and recreation. The BLM manages the public lands so they can be used in many ways.

BLM Photo

4

The BLM is also responsible for preserving and protecting wildlife habitat, vegetation, soil, and ancient items, as well as special places such as wilderness areas, wild and scenic rivers, and historic sites.

BLM's management of the public lands is based on conservation, which is the wise use of our natural resources. BLM's mission is to keep the public lands and resources healthy and productive so people can use and enjoy them now and in the future.

5

Photo by Faye Winters, BLM

Skulls, Antlers, and Horns

Understanding the Natural History of Animals

Skulls, Antlers, and Horns—Understanding the Natural History of Animals

National Science Education Standards

The presentations and accompanying activities for this topic align with the following National Science Education Standards:

Grades 9-12

- Content Standard A: Science as Inquiry (abilities necessary to do scientific inquiry, understandings about scientific inquiry)
- Content Standard C: Life Science (biological evolution, interdependence of organisms)

Grades 5-8

- Content Standard A: Science as Inquiry (abilities necessary to do scientific inquiry, understandings about scientific inquiry)
- Content Standard C: Life Science (structure and function in living systems, regulation and behavior, populations and ecosystems, diversity and adaptations of organisms)

Grades K-4

- Content Standard A: Science as Inquiry (abilities necessary to do scientific inquiry, understandings about scientific inquiry)
- Content Standard C: Life Science (characteristics of organisms, organisms and environments)

Presentation for Grades 9-12

Photo collage (see slide key for photo credits)
1

We can tell much about how an animal lived from its skeleton.

Photo by William Dean, BLM
2

Almost everything we know about dinosaurs, such as this Tyrannosaurus rex, we learned from studying their skulls and other bones.

© John Von Niel
3

Although much can be learned from the entire skeleton, amateur naturalists and scientists alike gain valuable information about animals from their skulls. Researchers often use skull measurements to designate subspecies of animals. Evolutionary paths can be traced according to differences among different species. The health of a population or an individual can sometimes be evaluated through measurements of bone density or antler or horn size as compared to age.

© John Von Niel
4

For the naturalist, a skull found in the woods opens the door to a variety of questions: What animal left this behind? How did this animal live? What did it eat? How did it die? Unless you are an expert, you may not be able to tell exactly which species the skull is from, but you can still learn a lot about the animal from the clues the skull provides.

Presenter Tip: Determining the exact identity of a skull is less important than being able to recognize characteristics that lead us to understand the natural history of the animal. Questions like "What did this animal eat?" or "How big was this animal?" are preferred over "What animal was this?"

Environmental Education Programs

Fast Fact: ALWAYS USE CAUTION! For health reasons, you should never pick up a skull that still has flesh attached. Skeletal remains should not be handled until they are properly cleaned.

© John Von Niel

5

Three characteristics of a mammal skull will help determine the identity of the animal and tell us some facts about how it lived. First, look at the shape of the teeth. Sharp and pointed teeth are for eating meat. Flat, broad teeth are for grinding plants. Also note the number of teeth. The fewer teeth a mammal has, the more specialized its diet. Second, look at the size and placement of the eye sockets. Large eye sockets usually mean an animal was nocturnal. Eyes that point forward give an animal stereoscopic or three-dimensional vision, which is good for hunting. Eyes that point to the sides provide an animal with a wide field of view, which is good for spotting predators. Third, look at the size of the skull. That will help you to narrow down which animals are either too large or too small to have had this skull.

Enrichment: Ask the students to describe the teeth and eye sockets of the skull shown. This skull has sharp teeth and forward-facing eye sockets. See if the students can guess what the animal ate based on these characteristics. Both of these characteristics indicate that the skull is from a meat-eater. Then see if the students can narrow down what animal this skull is from. This skull is, in fact, from a coyote.

© John Von Niel

6

If a skull is from another type of animal, such as a bird, it will look very different than a mammal skull. Birds have no teeth, so we have to get clues about what they ate from the shape of their beaks or mouths. This owl skull has a hooked bill, which is similar to sharp teeth and is useful for tearing flesh. It also has eye sockets that are facing forward. From these clues, we can guess that this bird was a hunter and therefore a meat-eater.

7

© John Von Niel

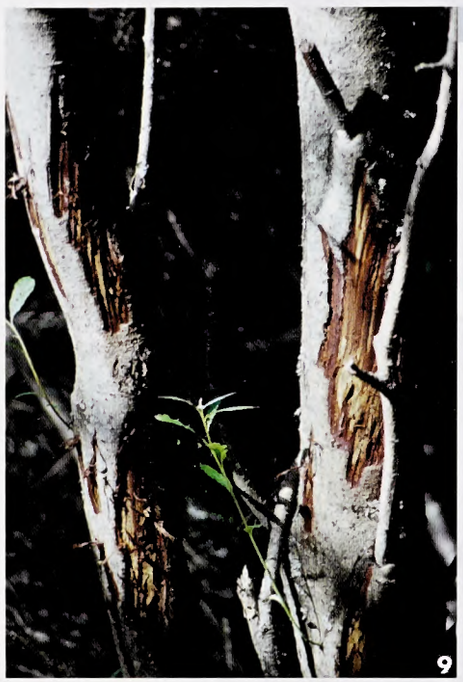
The size of a skull will look smaller than the size of the animal's head when it was alive. An owl's skull is really no wider than its eyes, but a live owl has skin, muscle, and lots of feathers covering the bone.

Fast Fact: Only mammals have two points of attachment from their skulls to their spines. All other vertebrates have a single point of attachment. That is one reason why a bird's neck is more flexible than ours is. Owls can rotate their heads about 270 degrees.

Enrichment: Research the size and shape of an owl's eye socket and how the skull has evolved to hold such big organs.

8
© Justin Stevenson

To study animals and their skulls, let's divide them into groups by the type of food they eat. The first group is plant-eaters or herbivores. A beaver is a plant-eater.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© John Van Niel

The front teeth or incisors of a beaver are shaped like chisels so they can scrape the tough outer bark off a tree to get at the soft green layer below. Beavers also use their front teeth to cut down trees, which they use as building material for their lodges and dams.

Beavers have an extra hard coating of orange enamel on their front teeth to keep them from wearing away too quickly. Their eyes are located on the sides of their heads so they can have a wider field of view, which helps them look for danger. Beavers also have flat heads. Animals that are semiaquatic, or that spend a great deal of time in the water, often have flat heads. Their ears, eyes, and nose are near the top to allow them to see, hear, and breathe while staying hidden underwater.

10
© John Van Niel

Environmental Education Programs

Fast Fact: Animals that burrow often have skulls with flat tops as well. Peeking out from underground is similar to looking above the water line. Marmots, river otters, and prairie dogs are a few animals with flat-topped skulls.

© John Van Niel

11

The arctic ground squirrel is also a plant-eater. This one is eating flower buds. The flat teeth found along its cheek will grind the food thoroughly so it is easier to digest.

Enrichment: Think of a mammal that has a body adapted to eating each of the following plant parts: fruit, seeds, leaves, and nectar.

The beaver and ground squirrels are similar to the cottontail rabbit shown here, but they are not very closely related. Although they eat plants like rodents do, rabbits, hares, and pikas have four incisors on their top jaws, while rodents have only two. They have two small incisors BEHIND the larger front ones instead of having all their teeth in a row.

12

© John Van Niel

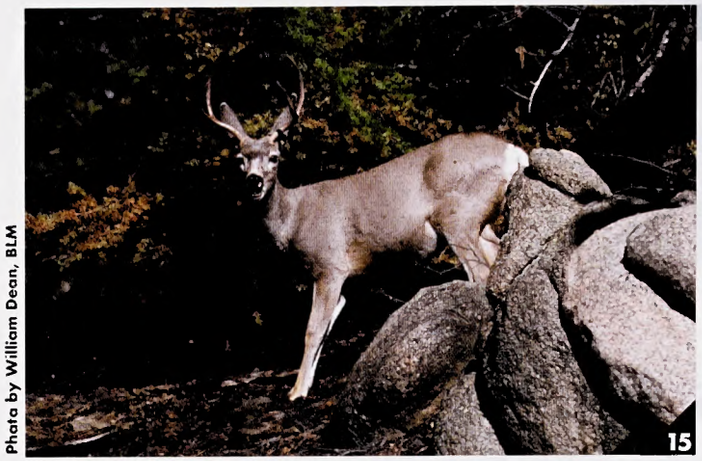
Photo by William Deon, BLM

13

This skull can be identified easily as a medium-sized plant-eater just by looking at the teeth, eye sockets, and overall size of the skull.

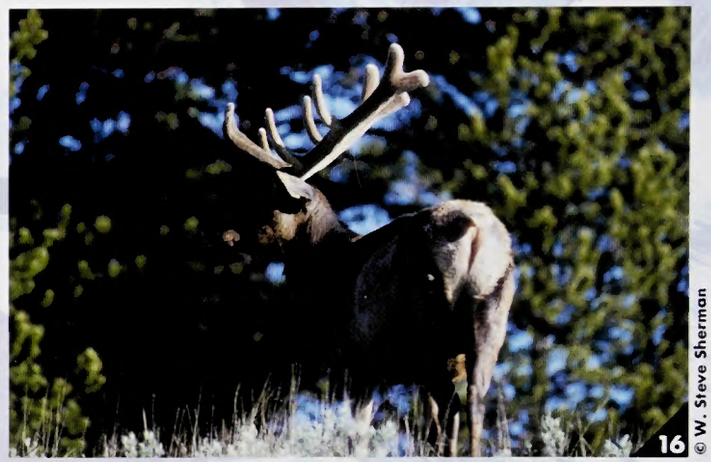
Hoofed mammals are another set of plant-eaters found in North America. Not only are their skulls distinctive, but each species grows distinctively shaped horns or antlers that help us identify them.

14
© William Banaszewski


15
Photo by William Dean, BLM

Only members of the deer family grow antlers. Antlers are grown and shed each year. Usually, antlers branch or fork, although young animals may grow a set or two of spikes. Antlers are normally only found on the male of the species, except in caribou. Female caribou often grow a set of small antlers. Occasionally, antlered females are found in all deer species.

Fast Fact: Antler growth in female deer (except caribou) is rare and occurs in less than 1 out of every 10,000 deer. It is caused by excessive amounts of testosterone. These antlers usually do not lose their velvet in the fall and are typically small.


16
© W. Steve Sherman

At the start of spring, males in the deer family, such as this bull elk, begin growing their antlers. Antlers grow from two permanent bones located on the top of their heads called pedicles. While they are growing, antlers are covered by a soft skinlike tissue called velvet. Velvet contains thousands of blood vessels that carry calcium and other minerals to nourish the growing antler bone.

17
© W. Steve Sherman

Antlers reach full size after about 4 months. The size of the antlers depends on three things: the quality of the food the bull eats; genetics (characteristics inherited from the bull's father), and age. Good nutrition is extremely important for growing large antlers.

© Milo Burcham
18

By about August, the bull's antlers have hardened and the velvet begins to peel off. The bull rubs on bushes and trees to remove any remaining velvet and create signposts visible to other elk.

During the fall, male deer, elk, and moose will use their antlers to compete with other males of their species to determine social status. These competitions can be described as "shoving matches" and rarely result in serious injury to either animal.

Fast Fact: Although rare, animals can injure or even kill a rival in these contests. Even more unusual, antlers can "lock" together, resulting in the death of both animals. There is much evidence to show that deer can judge a rival's antler size against their own and thus avoid mismatched battles.

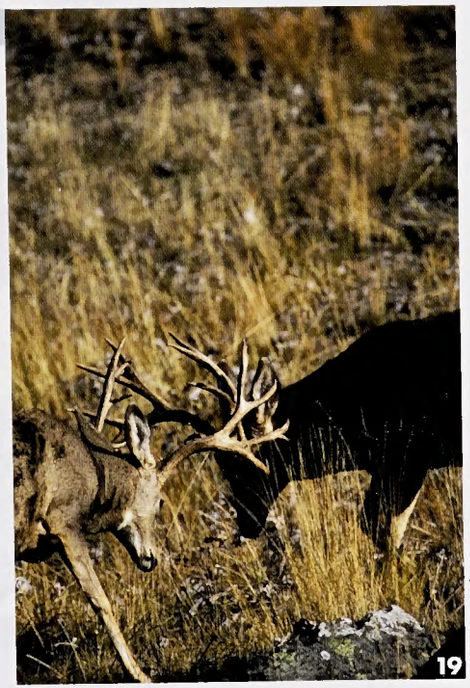

19
© Milo Burcham

Photo by William Dean, BLM
20

Over the winter, the antlers harden next to the skull until one day they break off. If you find a dropped antler in the field, look around—you may get lucky and find the other nearby.

Horns, on the other hand, are not shed, usually do not branch, and are found on both males and females. The males, such as this billy goat, generally grow larger horns than the females do.

© John Van Niel
21

The horn itself is a sheath that covers a bone core that is a part of the skull. Even if the sheath is missing, it is easy to determine if a skull had horns.

Fast Fact: Another feature to look for in these skulls is an eye socket that is completely surrounded by bone. This may be an adaptation to protect the eyes from the antlers and horns of other members of their species.

Photo by William Dean, BLM

22

© W. Steve Sherman

23

Horns determine rank among bighorn sheep, and head-butting contests between males are common. Bighorns have very thick skulls and are usually unharmed at the end of these contests, but the dominant male has been determined. Dominant males may have more breeding opportunities, so these contests are important.

Pronghorns are an exception to the horn rules. Pronghorns do lose their sheaths annually and their horns are forked, which is how they got their name.

© W. Steve Sherman

24

© John Von Niel

25

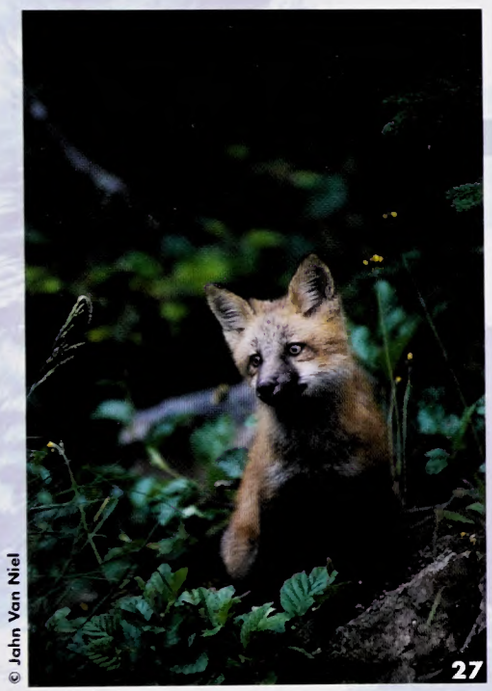
Meat-eaters, or carnivores, are the second group of animals. They have a different set of skull characteristics. This wolf skull shows pointed teeth all along the jaw and many small front teeth for nipping meat from the bone. The eyes are facing forward to provide a three-dimensional view of its prey.

© John Van Niel 26

Fast Fact: The sagittal crest (the ridge on the top of the skull) is where the jaw muscles attach. The bigger the sagittal crest, the stronger the jaws. Other animals with large sagittal crests include turtles, opossums, and most other predators. One plant-eater with a noticeable sagittal crest is the beaver.

Carnivores will often kill their food, but many will also act as scavengers and eat the remains of dead animals they find. Carnivores often go for long periods of time between meals. Wolves can gorge themselves on a single meal because they have a large stomach. Their teeth are not good for chewing, so wolves often swallow large pieces of meat. Add to that the need to eat quickly for fear of losing your place to another member of the pack, and you can easily see how the expression "wolfing down your food" came about.

Enrichment: Ask a few students to tell you a single word to describe this picture. How many students thought it was a snarl, growl, or other threat? In fact, this is a photograph of a wolf in mid-yawn. Discuss how images can often evoke emotion and captions used in conjunction with a photo may lead the observer to a predisposed conclusion. Similarly, observations of animals in the wild are often misunderstood. Careful study and examination are required to make truly objective conclusions about wildlife behavior.


© John Van Niel 27

Red foxes are much smaller than wolves and they often cache or bury excess food for consumption later. Both the wolf and fox (along with coyotes) are members of the dog family (or canids) and have skulls with long snouts.

Although red foxes will eat plant material like berries in season, their teeth are adapted to eating meat.

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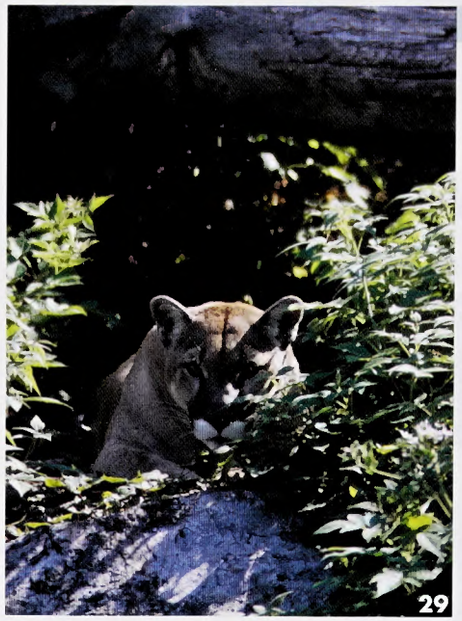

© John Van Niel

Members of the cat family are also carnivores. Mountain lions, also called cougars, pumas, and panthers, are true carnivores and rarely eat plants. They also have fewer teeth than many other carnivores. A mountain lion normally has 24 teeth, while a wolf typically has 44 teeth.

A smaller member of the cat family, the bobcat, is a wide-ranging predator that eats birds and small rodents.

Cat skulls are easy to recognize. Cats have short snouts, so their skulls are almost round in shape. They also have excellent night vision, and therefore, large eye sockets.

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Weasels are carnivores as well. Weasel skulls are usually long, but their eyes are set forward in the skull. As you can see on this badger skull, more than half of the skull is found behind the eyes. The large brain is elongated in weasels rather than bulging as in many mammals. This shape can be useful for several reasons.

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One reason is that many weasels, like this badger, live in holes. Badgers are known to be good diggers. They have sharp claws for making burrows and for digging for their prey. Their long, narrow heads are easy to push into a hole.

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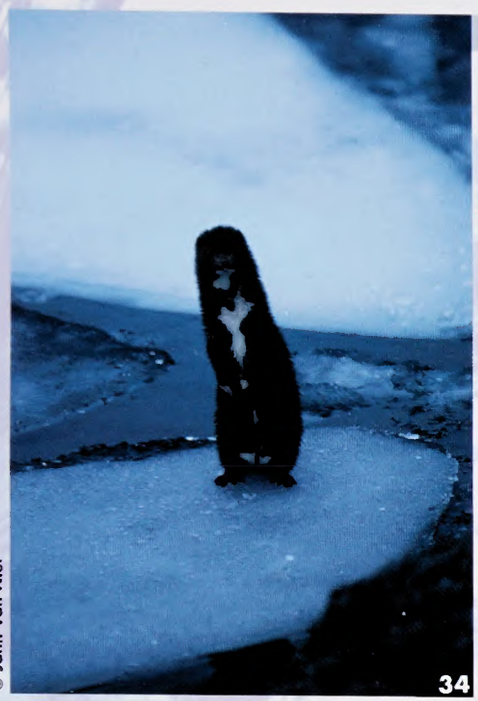

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Members of the weasel family have long bodies to match their skulls. The long body of a mink or weasel allows it to gain enough leverage to be able to kill prey larger than you would think possible for an animal of its weight.

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The last group of animals are those that eat both plants and animals, or omnivores. Bears are omnivores. This black bear skull shows a mixture of flat teeth for grinding plants and sharp teeth for eating meat. Most black bears eat more plants than they do meat. In some places, their diet consists of 75 percent plants and only 25 percent meat (much of which is scavenged). Bears will eat berries, eggs, bugs, and animals they kill or find dead. This variability in diet allows them to take advantage of different types of food that become available in different seasons.

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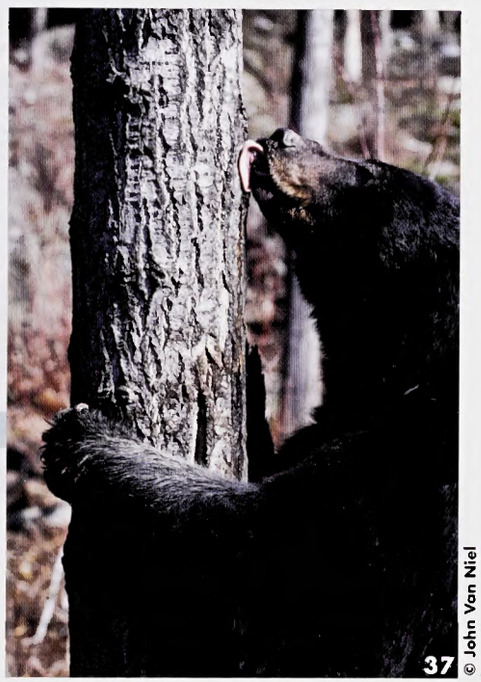
Bears will also eat human food. However, human food is not healthy for wildlife. In addition, any bear that learns it can get food from people can cause problems by coming too close to them. "A fed bear is a dead bear" is a saying that refers to the fact that nuisance bears often are killed due to human safety concerns.

Bears and other wildlife should be left alone to find food on their own, which is their natural behavior.



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Enrichment: Ask students to think of several ways that feeding birds in a backyard feeder is different than feeding large mammals in parks or campgrounds.

Raccoons are also omnivores. By looking at this skull, you can see why raccoons are nicknamed "little bears." This skull looks very much like the bear skull because both animals eat similar foods. Notice the combination of flat teeth for grinding plants and sharp teeth for acquiring meat. The diet of a raccoon includes berries, tadpoles, insects, and scavenged flesh.

38

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Raccoons will eat human food as well. They live in areas where humans leave pet food out or garbage uncovered. In fact, the highest numbers of raccoons are often in cities and suburbs, not in wilderness areas.

To review, we first learned that the skull of an animal can tell us a great deal about that animal. The type of teeth, the placement of the eyes, and the overall size of the skull are clues to the identity and lifestyle of the species.

40

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41

Photo collage (see slide key for photo credits)

Animals that eat plants have broad flat teeth for grinding tough plant material. Many have front teeth that act as chisels. Their eyes are usually found on the sides of their heads for a wide field of view. Rodents and rabbits are common herbivores.

Some herbivores have horns or antlers. Remember, antlers usually branch, are not common in females, and are shed every year. Horns usually don't branch, are found in both sexes, and do not fall off.

42

Photo collage (see slide key for photo credits)

Photo collage (see slide key for photo credits)
43

Meat-eaters have sharp, pointed teeth for stabbing and tearing meat. Their eyes usually face forward to give them better depth perception while hunting. Members of the dog and cat families are carnivores.

Animals that eat both plants and meat have a mixture of the two types of teeth. Bears and raccoons are two good examples of omnivores.

Photo collage (see slide key for photo credits)
44

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45

So the next time you see a mammal, think of the bones underneath the skin that give it its shape.

The study of skulls and bones continues to give us insights into the lives of the animals around us.

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46

Presentation for Grades 5-8

1 We can tell much about how an animal lived from its skeleton.

2 Almost everything we know about dinosaurs, such as this Tyrannosaurus rex, we learned from studying their skulls and other bones.

3 Skulls can tell us a great deal about an animal. By measuring skulls, scientists can tell what animal they came from. By looking at similarities in skulls, scientists can tell which species are related. Skulls can even provide information about the health of an animal.

4 If you are hiking and find a skull in the woods, you can become an investigator: What animal left this behind? How did it live? What did it eat? Unless you are an expert, you may not be able to tell exactly which species the skull is from, but you can still learn a lot about the animal from the clues the skull provides.

Presenter Tip: Determining the exact identity of a skull is less important than being able to recognize characteristics that lead us to understand the natural history of the animal. Questions like "What did this animal eat?" or "How big was this animal?" are preferred over "What animal was this?"

Fast Fact: ALWAYS USE CAUTION! For health reasons, you should never pick up a skull that still has flesh attached. Skeletal remains should not be handled until they are properly cleaned.

5 A skull found in the woods will likely be that of a mammal. There are three characteristics of a mammal skull that will help you figure out what animal it came from and how that animal lived. First, look at the shape of the teeth. Sharp and pointed teeth are for eating meat. Flat, broad teeth are for grinding plants. Second, look at the size and placement of the eye sockets. Large eye sockets usually mean an animal was active at night. Eyes that point forward give an animal three-dimensional vision, which is good for hunting. Eyes that point to the sides provide an animal with a wide field of view, which is good for spotting predators. Third, look at the size of the skull. That will help you to narrow down which animals are either too large or too small to have had this skull.

Enrichment: Ask the students to describe the teeth and eye sockets of the skull shown. This skull has sharp teeth and forward-facing eye sockets. See if the students can guess what the animal ate based on these characteristics. Both of these characteristics indicate that the skull is from a meat-eater. Then see if the students can narrow down what animal this skull is from. This skull is, in fact, from a coyote.

6 If a skull is from another type of animal, such as a bird, it will look very different than a mammal skull. Birds have no teeth, so we have to get clues about what they ate from the shape of their beaks or mouths. This owl skull has a hooked bill, which is similar to sharp teeth and is useful for tearing flesh. It also has eye sockets that are facing forward. From these clues, we can guess that this bird was a hunter and therefore a meat-eater.

7 Often animal skulls look smaller than what you might expect. An owl's skull is really no wider than its eyes, but a live owl has skin, muscle, and lots of feathers covering the bone.

Fast Fact: Only mammals have two points of attachment from their skulls to their spines. All other vertebrates have a single point of attachment. That is one reason why a bird's neck is more flexible than ours is. Owls can rotate their heads about 270 degrees.

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8 To study animals and their skulls, let's divide them into groups by the type of food they eat. The first group is plant-eaters or herbivores. A beaver is a plant-eater.

9 The front teeth or incisors of a beaver are shaped like chisels so they can scrape the tough outer bark off a tree to get at the soft green layer below. Beavers also use their front teeth to cut down trees, which they use as building material for their lodges and dams.

10 Beavers have an extra hard coating of orange enamel on their front teeth to keep them from wearing away too quickly. Their eyes are located on the sides of their heads so they can have a wider field of view, which helps them look for danger. Beavers also have flat heads. Animals that are semiaquatic, or that spend a great deal of time in the water, often have flat heads. Their ears, eyes, and nose are near the top to allow them to see, hear, and breathe while staying hidden underwater.

Fast Fact: Animals that burrow often have skulls with flat tops as well. Peeking out from underground is similar to looking above the water line. Marmots, river otters, and prairie dogs are a few animals with flat-topped skulls.

11 The arctic ground squirrel is also a plant-eater. This one is eating flower buds. The flat teeth found along its cheek will grind the food thoroughly so it is easier to digest.

Enrichment: Think of a plant you eat that goes "crunch" when you grind it with your teeth.

14 Hoofed mammals are another set of plant-eaters found in North America. Many of these animals grow horns or antlers that help us identify their skulls. First, we need to learn how to tell antlers from horns.

15 Only members of the deer family grow antlers. Antlers are grown and shed each year. Usually, antlers branch or fork. Antlers are normally only found on the male of the species, except in caribou. Female caribou often grow a set of small antlers.

Fast Fact: Antler growth in female deer (except caribou) is rare and occurs in less than 1 out of every 10,000 deer. It is caused by excessive amounts of testosterone. These antlers usually do not lose their velvet in the fall and are typically small.

16 At the start of spring, males in the deer family, such as this bull elk, begin growing their antlers. While they are growing, antlers are covered by a soft skinlike tissue called velvet.

17 Antlers reach full size after about 4 months. Good nutrition is extremely important for growing large antlers.

18 By about August, the bull's antlers have hardened and the velvet begins to peel off. The bull rubs on bushes and trees to remove any remaining velvet and to leave marks for other elk to see.

19 During the fall, male deer, elk, and moose will use their antlers to compete with other males of their species to see which one is strongest. These competitions can be described as "shoving matches" and rarely result in serious injury to either animal.

Fast Fact: Although rare, animals can injure or even kill a rival in these contests. Even more unusual, antlers can "lock" together, resulting in the death of both animals. There is much evidence to show that deer can judge a rival's antler size against their own and thus avoid mismatched battles.

20 Over the winter, the antlers harden next to the skull until one day they break off. If you find a dropped antler in the field, look around—you may get lucky and find the other nearby.

21 Horns, on the other hand, are not lost each year, usually do not branch, and are found on both males and females. The males, such as this billy goat, generally grow larger horns than the females do.

22 The horn itself is a covering over a bone that is a part of the skull. Even if

the covering is missing, it is easy to tell if a skull had horns.

Fast Fact: Another feature to look for in these skulls is an eye socket that is completely surrounded by bone. This may be an adaptation to protect the eyes from the antlers and horns of other members of their species.

23 Horns determine rank among bighorn sheep, and head-butting contests between males are common. Bighorns have very thick skulls and are usually unharmed at the end of these contests.

24 Pronghorns are an exception to the horn rules. Pronghorns do lose their sheaths each year and their horns are forked, which is how they got their name.

25 Meat-eaters, or carnivores, are the second group of animals. They have a different set of skull characteristics. This wolf skull shows pointed teeth all along the jaw and many small front teeth for nipping meat from the bone. The eyes are facing forward to provide a three-dimensional view of its prey.

Fast Fact: The sagittal crest (the ridge on the top of the skull) is where the jaw muscles attach. The bigger the sagittal crest, the stronger the jaws. Other animals with large sagittal crests include turtles, opossums, and most other predators. One plant-eater with a noticeable sagittal crest is the beaver.

26 Carnivores will often kill their food, but many will also act as scavengers and eat the remains of dead animals they find. Carnivores often go for long periods of time between meals. Wolves can gorge themselves on a single meal because they have a large stomach. Their teeth are not good for chewing, so wolves often swallow large pieces of meat. Add to that the need to eat quickly for fear of losing your place to another member of the pack, and you can easily see how the expression "wolfing down your food" came about.

Enrichment: Ask a few students to tell you a single word to describe this picture. How many students thought it was a snarl, growl, or other threat? In fact, this is a photograph of a wolf in mid-yawn. Discuss how images can often evoke emotion and captions used in conjunction with a photo may lead the observer to a predisposed conclusion. Similarly, observations of animals in the wild are often misunderstood. Careful study and examination are required to make truly objective conclusions about wildlife behavior.

29 Members of the cat family are also carnivores. Mountain lions, also called cougars, pumas, and panthers, are true carnivores and rarely eat plants. They have fewer teeth than many other carnivores.

30 A smaller member of the cat family, the bobcat, eats birds and small rodents.

31 Cats have short snouts, so their skulls are almost round in shape. They also have excellent night vision, and therefore, large eye sockets. Cat skulls are easy to recognize.

32 Weasels are carnivores as well. Weasel skulls are usually long, but their eyes are set forward in the skull. As you can see on this badger skull, more than half of the skull is found behind the eyes. This shape can be useful for several reasons.

33 One reason is that many weasels, like this badger, live in holes. Badgers are known to be good diggers. They have sharp claws for making burrows and for digging for their prey. Their long, narrow heads are easy to push into a hole.

34 Members of the weasel family have long bodies to match their skulls. The long body of a mink or weasel allows it to gain enough leverage to be able to kill prey larger than you would think possible for an animal of its weight.

35 The last group of animals are those that eat both plants and animals, or omnivores. Bears are omnivores. This black bear skull shows a mixture of flat teeth for grinding plants and sharp teeth for eating meat. Most black bears eat more plants than they do meat. Bears will eat berries, eggs, bugs, and animals they kill or find dead.

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36 Bears will also eat human food. However, human food is not healthy for wildlife. In addition, any bear that learns it can get food from people can cause problems by coming too close to them.

37 Bears and other wildlife should be left alone to find food on their own, which is their natural behavior.

Enrichment: Ask students to think of several ways that feeding birds in a backyard feeder is different than feeding large mammals in parks or campgrounds.

38 Raccoons are also omnivores. By looking at this skull, you can see why raccoons are nicknamed "little bears." This skull looks very much like the bear skull because both animals eat similar foods. The diet of a raccoon includes berries, tadpoles, insects, and scavenged flesh.

39 Raccoons will eat human food as well. They live in areas where humans leave pet food out or garbage uncovered. In fact, the highest numbers of raccoons are often in cities and suburbs, not in wilderness areas.

40 To review, we first learned that the skull of an animal can tell us a great deal about that animal. The type of teeth, the placement of the eyes, and the overall size of the skull are clues to the identity and lifestyle of the species.

41 Animals that eat plants have broad flat teeth for grinding tough plant material. Many have front teeth that act as chisels. Their eyes are usually found on the sides of their heads for a wide field of view. Rodents and rabbits are common herbivores.

42 Some herbivores have horns or antlers. Remember, antlers usually branch, are not common in females, and are shed every year. Horns usually don't branch, are found in both sexes, and do not fall off.

43 Meat-eaters have sharp, pointed teeth for stabbing and tearing meat. Their eyes usually face forward to give them better depth perception while hunting. Members of the dog and cat families are carnivores.

44 Animals that eat both plants and meat have a mixture of the two types of teeth. Bears and raccoons are two good examples of omnivores.

45 So the next time you see a mammal, think of the bones underneath the skin that give it its shape.

46 And remember that an animal's skull tells us much about how it lived.

Presentation for Grades K-4

1 We can learn a great deal about an animal from its bones.

3 Scientists can measure a skull to tell what animal it came from.

4 If you are hiking and find a skull in the woods, you can look for clues to figure out what animal it is from and what that animal was like.

Presenter Tip: Determining the exact identity of a skull is less important than being able to recognize characteristics that lead us to understand the natural history of the animal. Questions like "What did this animal eat?" or "How big was this animal?" are preferred over "What animal was this?"

Fast Fact: ALWAYS USE CAUTION! For health reasons, you should never pick up a skull that still has flesh attached. Skeletal remains should not be handled until they are properly cleaned.

5 There are three clues to look for on a mammal skull. First, look at the teeth. Sharp and pointed teeth are for eating meat. Flat, broad teeth are for grinding plants. Second, look at the holes where the eyes were. If they are large, the animal was probably active at night. If they point forward, the animal was likely a hunter. If they point to the sides, the animal could see a wider area and watch for danger. Third, look at the size of the skull. Then you can figure out what animals were too large or too small to have had this skull.

6 Bird skulls look very different. Birds have no teeth, so we have to get clues about them from the shape of their beaks or mouths. This owl skull has a hooked bill, which is like sharp teeth. Its eye sockets are facing forward. So we can guess that it was a hunter and ate meat.

7 The owl's skull is smaller than what you might expect. A live owl seems bigger because it has skin, muscle, and lots of feathers.

8 Animals can be split into groups by the type of food they eat. The first group is plant-eaters or herbivores. A beaver is a plant-eater.

9 Beavers have large front teeth that they use to scrape off bark and cut down trees.

10 They have eyes on the sides of their heads. They also have flat heads and their ears, eyes, and nose are near the top, which lets them hide underwater.

11 The arctic ground squirrel is also a plant-eater. The flat teeth found along its cheek help it grind flower buds and other plants.

14 Hoofed mammals are another group of plant-eaters. Many of these animals grow horns or antlers. First, we need to learn how to tell antlers from horns.

15 Members of the deer family grow antlers. Antlers are grown and shed each year. They usually branch or fork. They are normally only found on males, except in caribou.

16 Antlers begin growing in the spring. They are covered by a soft skinlike tissue called velvet.

18 By August, the antlers have hardened and the velvet begins to peel off.

19 During the fall, male deer, elk, and moose have "shoving matches" with their antlers to see which one is strongest.

20 Over the winter, the antlers harden next to the skull until one day they break off.

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21 Horns are not grown and lost each year. They usually do not branch, except on pronghorns. They are found on both males and females but are usually bigger on males.

22 Horns are a covering over a bone that is a part of the skull. Even if the covering is missing, it is easy to tell if a skull had horns.

23 Among bighorn sheep, leaders are determined by their horns. Head-butting contests between males are common.

25 Meat-eaters are the second group of animals. They are also called carnivores. Their skulls are different than plant-eaters. A wolf is a meat-eater. Its skull has pointed teeth all along the jaw, with many small front teeth for pulling meat from the bone. Its eyes face forward.

29 Members of the cat family such as this mountain lion, are also meat-eaters.

31 All cats have very good night vision, so they have large eye sockets. They also have shorter snouts and fewer teeth. Cat skulls are almost round and easy to recognize.

32 Weasels are carnivores as well. They have long skulls, with eyes toward the front of the skull.

33 Many weasels live in holes. They can easily push their long, narrow heads into a hole.

35 The third group of animals eat both plants and animals. They are called omnivores. Bears are omnivores. They have both flat teeth for grinding plants and sharp teeth for eating meat.

36 Bears will also eat human food. You should never feed them, though, because they can become dangerous.

38 Raccoons are also omnivores. They are nicknamed "little bears." Their skulls look very much like bear skulls because they eat similar foods.

39 Raccoons will eat human food, too. Many of them live in cities where they can find pet food and garbage.

40 We have learned that a skull can tell us many things about an animal. The teeth, the eyes, and the size of the skull are clues to what the animal was and how it lived.

41 Each kind of animal has different features. Animals that eat plants have broad, flat teeth for grinding. Many have front teeth that act as chisels. Their eyes are often found on the sides of their heads so they can see around them better. Rodents and rabbits are plant-eaters.

42 Some plant-eaters have horns or antlers. Remember, antlers usually branch, are usually on males, and are shed every year. Horns usually don't branch, are found on both males and females, and do not fall off.

43 Meat-eaters have sharp, pointed teeth for cutting and tearing meat. Their eyes usually face forward, which helps them hunt. Members of the dog and cat families are meat-eaters.

44 Animals that eat both plants and meat have both types of teeth. Bears and raccoons are omnivores.

45 So the next time you see a mammal, think of the bones underneath the skin that give it its shape.

46 And remember that an animal's skull tells us much about how it lived.

Extension Activities

Animal Relay (Grades K-4)

Objective: Students will learn natural history facts about several mammal species.

Materials: 3- x 5-inch cards, several containers (small boxes or cans).

Background: This activity is easily modified for use in a variety of ways. Be creative!

Method: Create two sets of 3- x 5-inch cards for the mammal species you wish the students to learn about. Common names can be written on each card for older students and pictures or drawings of the animals or skulls of the animals can be used for younger students. The sets should be identical in content, but easily distinguished from each other in some way (perhaps through the use of different colors for text or borders).

The class can be divided into two teams with each student receiving a card. This activity does not have to be conducted as a competition between two teams (although the example here shows a very nonthreatening competition). The teacher then asks students a question and presents containers labeled with possible answers. Students take turns going to the front of the room and depositing their cards in the correct container.

For example, a mammal species card is given to each student. Three containers are displayed. One has the term "plants," one has "animals," and one has "plants AND animals" written on it (younger students will need pictures or drawings to convey the same idea). The teacher asks: "Which answer best describes what your animal eats?"

Students should not discuss their answers with anyone, nor should they show their card to any other student. After all cards are placed in the containers, the teacher tallies them with the help of the class to see which team has the most correct answers. As each card is taken out of the container, the teacher asks: "Is this card in the right container? Why or why not?" Mammals may be sorted by other categories, including size, habitat, range, horns or antlers, and legal status (such as endangered or not).

EXAMPLES:

Question: What does your animal eat?

Plants	Animals	Plants & Animals
Deer	Wolf	Black Bear
Elk	Cougar	Raccoon
Beaver	Mink	Human
Rabbit	Bobcat	
Mountain Goat		

Question: Does your animal have horns or antlers?

Horns	Antlers
Sheep	Elk
Mountain Goat	Moose
Bison	Mule Deer
Pronghorn	Caribou

Mammal Flash Cards (Grades 5-8)

Objective: Students will learn natural history facts about several mammals by creating flash cards to use as references for identifying skulls and investigating mammal species relationships.

Materials: 3- x 5-inch cards, reference materials such as encyclopedias, field guides, and the Internet.

Background: Creating these flash cards will provide the students with a "list" of mammals common to their local area. Students will be able to answer questions regarding the characteristics of skulls and life histories of various mammal species by studying the natural history facts on the back of the cards.

Method: Provide students with a list of mammals in their area. Divide the list among the students. Have them work alone or in groups of two or more at your discretion. Prepare one card for each animal species. Write the common name of the species on the front of the card. Have the students research information on the species to complete the back of the card. The information should include at least the length of the animal (not including the tail), a description of the diet of the animal, and a few life history facts.

Once the cards are complete (at least a classroom set), they can be used in a variety of ways. For example, present an unknown skull to the class and allow the students to select all of the cards that represent species to which the skull might belong. To make the activity more challenging, do not allow students to use the reference material written on the back of the cards. Another activity would be to ask students to sort the cards according to characteristics (such as plant-eaters, mammals under 10 inches long, animals that spend a large amount of time in the water, etc.). Finally, the cards could be used in a traditional flash card format with the teacher quizzing students or students quizzing each other on the identity of a mammal by reading some or all of the information on the back of the card.

Skull Investigation (Grades 9-12)

Objective: Students will apply the principles learned during the presentation to predict the characteristics of specific mammal species skulls.

Materials: Copies of the worksheet and reference materials (preferably ones with no skull images). Skulls or images of skulls will be needed for the final portion of this activity.

Background: The concepts introduced during the presentation will be reinforced through repetition and use. Students should easily gain a measure of success through this activity.

Method: Provide students with copies of the attached worksheet. Assign students a mammal or two to research. Students may work alone or in small groups as desired. You may wish to assign the same species to several students to see if they each arrive at the same predictions. Allow them access to a variety of reference materials to complete the worksheets. It is best to have references that do not include pictures of skulls since students will be asked to predict skull characteristics based on their research about the animal's natural history. You may encourage them to try to first pencil in any information they already possess before they verify it for accuracy from the reference materials. Once the worksheet(s) are completed, review the predictions with the class before revealing the actual answers. Query students as to why they made the predictions that they did.

Skull Investigation Worksheet

Assignment: Using reference materials, provide the information requested below for a species of mammal. Then use that information to predict various characteristics of that animal's skull.

FACTS

Species: _____

Length (without tail): _____

Main food items include: _____

_____

_____

_____

_____

Check all that apply:

_____ most active at night
_____ spends a lot of time in the water
_____ burrows or digs holes or tunnels
_____ has horns
_____ has antlers
_____ has strong jaws

PREDICTIONS

1. Size of skull: _____

2. Description of teeth (check one):
   _____ sharp teeth throughout mouth
   _____ flat, wide teeth
   _____ mixture of flat and sharp teeth

3. Eye sockets (check one):
   _____ face forward
   _____ face to the sides

4. List any other predictions you can make based on your research:

_____

_____

_____

_____

_____

_____

_____

_____

Skull Identification (Grades 5-8, 9-12)

Objective: Students will learn to identify some common mammalian skull characteristics.

Materials: Skulls of several mammal species (representing herbivores, carnivores, and omnivores from several families). One copy of the attached worksheet should be available for each student.

Background: Every mammal species can be identified from the skull alone based on the teeth, size, and other characteristics. Some skulls are very similar in appearance and it can be frustrating for the novice to tackle their identification. This lesson provides a way to introduce students to the basics of skull identification and rewards them for providing reasonable answers. Students will be shown a skull and asked to create a list of animals it could be after looking at three characteristics. The goal will be to produce reasonable answers and not necessarily to narrow it down to a specific species.

The natural tendency for students is to want to know the identification of the skull immediately. This activity allows them to provide guesses at the start during a brainstorming session and then again after they have looked at the skull characteristics.

Method: Begin by holding up the skull of a local mammal and asking the students to guess its identity. Write all guesses on the board and add some additional animals yourself if the list is sparse. Do not reveal the identity of the skull. Ask a few of the students to tell you how they arrived at their guesses. Distribute the worksheet (attached) and explain that you will teach them a three-step process to help them identify skulls.

Proceed to step 1 of the worksheet. Ask students to examine the teeth of the skull you are holding and describe what they are designed to eat (meat, plants, or both). You may have to walk around the room so students can see the teeth. Now go to your list of student guesses and eliminate the animals with other feeding habits.

Step 2 involves estimating the size of the animal by looking at the size of its skull. As the worksheet indicates, the body of the mammal is roughly 3.5 times longer than the skull. Lay the skull against the blackboard and measure out the body size with the help of a student. Remind the students that this does NOT include tail length. Again, remove guesses from the board that are much too large or small to be correct.

Step 3 is the most difficult. The worksheet asks students to look for any distinguishing characteristics of the skull. It lists several, and gives the implications of those characteristics. Not every skull will show a "remarkable" trait. Other traits might need to be added for your particular needs. Finalize your list on the chalkboard by removing any animals that do not share the characteristics found in step three.

This activity is considered successful if the list you arrive at is a set of reasonable guesses. For example, if the skull chosen were a muskrat, a reasonable list would include marmot, ground squirrel, red squirrel, and rabbit. Younger students or groups with little background in wildlife will need more latitude when evaluating the success of the final list and more assistance in getting there. Also, compare the final list with the original list from the brainstorm session to show the value of investigation.

Remember to reward answers whenever possible. Try to find out what the student did correctly first. For example, if a student included mink in the list of possible answers for a muskrat, explain that a mink is the correct size (step 2) and that it does have a flat top (step 3) like a muskrat, but it is a meat-eater and therefore has different teeth (step 1).

Allow students to repeat the procedure with several different skulls. Encourage them to use references to determine the natural history of mammal species. Answer questions that help them complete each step.

Skull Identification Worksheet

Follow this three-step procedure to help discover the identity of the skull.

STEP 1: Look at all of the teeth found in the skull (and check for holes where teeth USED to be!). Which of the following best describes the teeth?

_____A. Sharp, pointed teeth from the front to the back = carnivore (meat-eater)

_____B. Flat, wide grinding teeth along the cheek, chisel-like teeth in front OR
Wide teeth along the cheek, no top front teeth = herbivore (plant-eater)

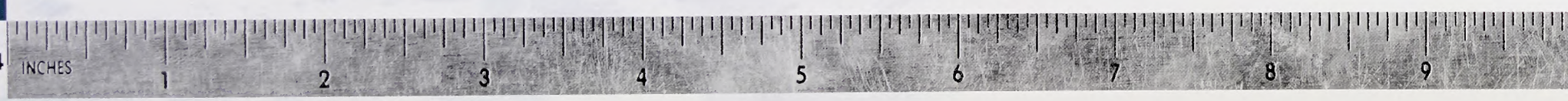
_____C. Sharp "fangs" but flat teeth along cheek = omnivore (plant- AND meat-eater)

STEP 2: Measure the skull with a ruler (inches or centimeters). This animal had a body that was about three and one half times longer than the skull. Since animals may have tails that are very long (mountain lion) or very short (black bear), this number indicates the body length ONLY.

_____ X 3.5 = _____
skull length body length
(tail not included)

STEP 3: Inspect the skull for special features. Often a single characteristic or two can help determine the identity. Here is a list of some features to look for and what they mean:

_____flat top of skull (usually means animal lives in water or uses a burrow)
_____large eye sockets (usually means the animal is active at night)
_____eye sockets that are completely surrounded by bone (found in mammals with hooves)
_____eye sockets pointing forward (usually means animal is a predator)
_____antlers or horns (found on many hoofed mammal skulls)
_____large ridge on the top of the skull (means the animal had strong jaws)



Skulls, Antlers, and Horns

Understanding the Natural History of Animals

The Wildlife Investigator Series

Environmental Education Programs

Match the animals with their skulls. Determine what the skull of each of these animals would look like. See if you can identify it in the picture above, and count how many times it appears. One of the skulls is from an animal that is not pictured here. Try to identify it and determine why its picture was not included.

Photo Credits: W. Banaszewski, M. Burcham, W. Dean, S. Sherman, J. Ván Niel

U.S. Department of the Interior
Bureau of Land Management

Poster Key

T-Rex Skull-1

Beaver Skull-3

Moose Skull-4

Raccoon Skull-6

Bison Skull-4

Wolf Skull-5

Mule Deer Skull-3

Antelope Skull-2

Black Bear Skull-2

Skulls, Antlers, and Horns Poster Key

Above are the animals the skulls in the poster belong to and the number of times they appear.

Wildlife Trees

The Value of Snags and Down Logs

Wildlife Trees— The Value of Snags and Down Logs

National Science Education Standards

The presentations and accompanying activities for this topic align with the following National Science Education Standards:

Grades 9-12

- Content Standard C: Life Science (interdependence of organisms)
- Content Standard F: Science in Personal and Social Perspectives (natural resources; environmental quality; natural and human-induced hazards; science and technology in local, national, and global challenges)

Grades 5-8

- Content Standard C: Life Science (regulation and behavior, populations and ecosystems)
- Content Standard F: Science in Personal and Social Perspectives (populations, resources, and environments; natural hazards)

Grades K-4

- Content Standard C: Life Science (characteristics of organisms, life cycles of organisms, organisms and environments)
- Content Standard F: Science in Personal and Social Perspectives (types of resources, changes in environments)

Presentation for Grades 9-12

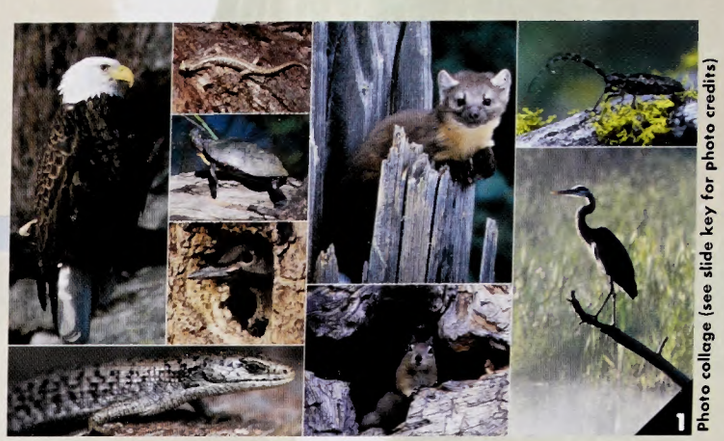


Photo collage (see slide key for photo credits)
1

Today we are going to talk about the many ways animals use trees. For several wildlife species, having dead trees in the forest is as important as having live ones. We'll also talk about how some live trees provide unique conditions that are useful to wildlife. Then we'll explore how forest management can reduce the amount of trees and logs available to wildlife and what can be done to lessen that impact.

Photo by William Deon, BLM
2

We all know that trees are important to people. Trees give us lumber to build homes, paper to create books, shade for our yards, and forests where we can hike and enjoy nature. But trees are important to many wild animals as well. Living or dead, trees are a vital part of our natural environment.

© John Von Niel
3

Photo by William Deon, BLM
4

When you are in a forest or near a river or stream, you may see standing dead trees with just a few branches. They may be partially rotted with holes and the bark may be loose or have fallen away. Often the top is broken off. These standing dead trees are called "snags."

Trees that have died and fallen to the ground are called "down logs" or "coarse woody debris."

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© Mila Burcham

5

Many species of wildlife need snags and down logs to survive, from small, seldom-seen, wood-boring beetles to larger, well-known woodpeckers. Wildlife use dead and dying trees for food, homes, and other needs.

Fast Fact: Snags can be separated into two groups: hard and soft. This grouping is important to wildlife biologists because some bird species can excavate nest cavities only in soft wood. For example, Lewis' and downy woodpeckers and white-breasted and red-breasted nuthatches prefer soft snags, and black-backed, pileated, and hairy woodpeckers prefer hard snags for nesting. Soft snags also provide food and shelter for invertebrates, like insects, on which many kinds of wildlife feed.

6

© Mila Burcham

Woodpeckers, of which there are 19 different species in North America, commonly use trees. Woodpeckers often drill nest holes in the decayed wood of snags. These holes are called cavities. Nesting inside a cavity provides protection against predators. Most animals use nesting holes that are no larger around than they are, which keeps larger predators out.

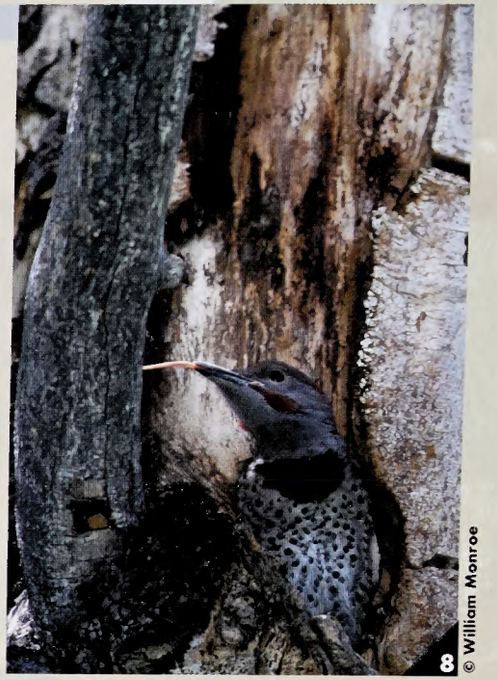
Fast Fact: Some birds nest in cavities created in soil instead of wood. Belted kingfisher, bank swallows, and Atlantic puffin are a few examples.

© W. Steve Sherman

7

Woodpeckers have straight, hard, pointed bills that they use as a chisel to peck or hack into trees. They do this to feed on insects or to create cavities in which they can nest, roost at night, and seek shelter from bad weather.

Woodpeckers have extraordinarily long tongues that they use to reach insects deep in holes and crevices. Their tongues are sticky and have barbs. They also have a spearlike tip to help them catch prey. Here is a juvenile northern flicker learning to use its tongue.


8 © William Monroe

9 © W. Steve Sherman

Woodpeckers are considered primary cavity nesters because they create the cavity and are the first to use it. Other birds and mammals that use the abandoned holes of woodpeckers are considered secondary cavity nesters. The mountain bluebird nests in cavities that were created by other animals or through other natural occurrences such as disease.

Fast Fact: House sparrows and European starlings are two birds that were introduced to North America from Europe. Both birds have spread over much of the continent and compete with native species for cavities to nest in. This competition can impact the survival of North American birds.

Many owls, such as the eastern screech owl, live and raise their young in existing cavities. Screech owls are smaller owls that grow to be 7 to 10 inches long. They have no ability to create holes themselves and use the holes left behind by woodpeckers. Screech owls typically lay four to five white eggs on the floor of a cavity with little or no nest material.

10 © Mila Burcham

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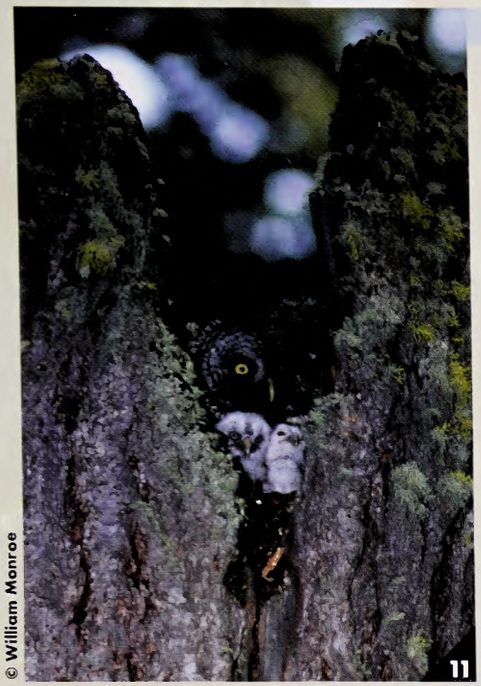


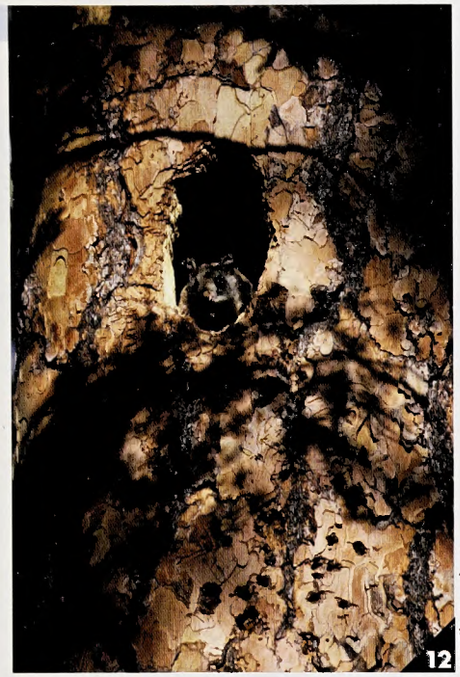
© William Monroe

11

Live trees and snags that break in half during windstorms are also useful to owls such as this great gray owl. Great gray and northern spotted owls are known for using trees that have broken tops, a bowl-shaped depression in the middle, and some wood and bark up the sides. These snags give the owls a platform to nest on and some protection from rain, snow, and wind.

Small mammals such as the northern flying squirrel use cavities in snags all year long for cover and to store food. Bats also use cavities in trees to raise their young and to hibernate. The snag cavity maintains the right temperature… not too hot and not too cold.

Fast Fact: The northern flying squirrel does not really fly, but glides from one tree to another on flaps of skin that extend between its front and rear legs. From a height of 60 feet, a flying squirrel can glide more than 160 feet.



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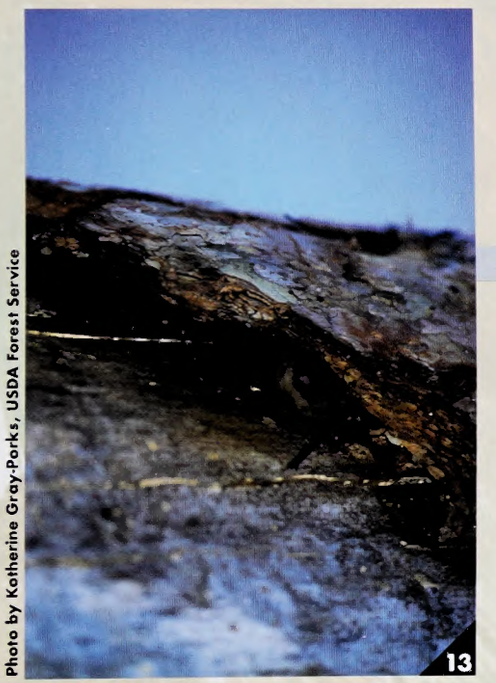

Photo by Kotherine Gray-Porks, USDA Forest Service

13

When the bark of dead trees becomes loose, lots of creatures benefit from the new space that is created between the bark and the core of the tree. During the summer, bats roost under the loose bark. Some birds, such as brown creepers, build nests under loose bark.

In some areas, black bears use large hollows in snags and live trees to hibernate. These dens provide females and young bears with sites that are safe from larger male bears that may prey on them.

Fast Fact: Many biologists do not consider bears to be true hibernators because they do not go completely into the deep sleep called torpor. Bears instead enter a semideep sleep state, often called winter dormancy, from which they can be aroused easily.

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Cavities also are used for food storage. When an animal such as a chipmunk accumulates food, it is called a cache. Rodents and other animals use snags to cache food for winter or early spring when food is scarce.

When snags and live trees fall to the ground, they continue to provide habitat for wildlife. Down logs, especially large logs, are often used by amphibians and mammals. Mice, squirrels, and rabbits often use down logs for cover and feeding sites.

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Marten den in and under logs and in hollow trees. They also use these structures as resting sites and to hunt squirrels and other prey that use these habitats.

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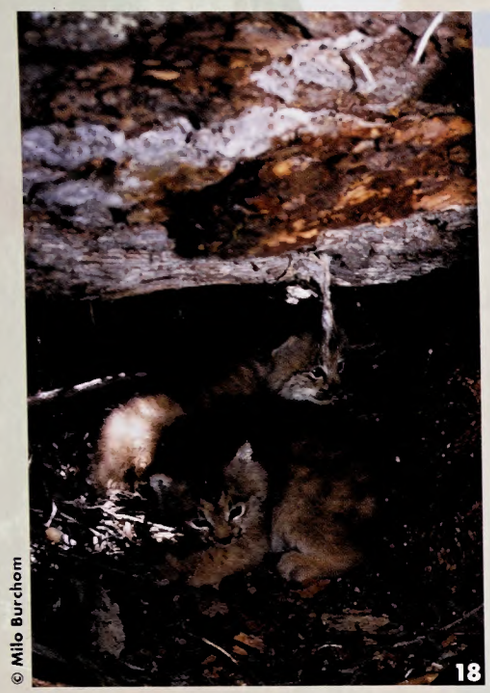

© Milo Burchom 18

Lynx will den in areas with many down logs that provide good hiding places for their young (kits).

Many amphibians and reptiles also use the different habitats available in and around snags and down logs. Clouded salamanders live under the bark, under the logs, and, during winter when they are not active, inside the logs. There they feed on mites, spiders, and ants. Frogs and salamanders spend most of their time in and around down logs, especially during the hot summer months, because there is more moisture and it is cooler down there.

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Reptiles, such as the northern alligator lizard, also live under loose bark and inside rotting logs where they feed on termites, beetles, and other insects.

Logs that have fallen into the water provide excellent habitat for fish and loafing platforms for waterfowl and turtles. Turtles need to warm themselves (bask) in the sunlight to maintain their body temperature. These turtles can escape a predator by quickly slipping into the water and swimming away.

Photo by William Deon, BLM 21

Wildlife also use trees, snags and logs to communicate. Birds of prey, such as bald eagles, communicate by perching in visible locations—on top of large trees and snags. Eagles can quickly spot each other on exposed perches, which helps them find mates, food, and night roosting sites. They often use dead trees because they are open and provide ample room for their 7-1/2- foot wingspan. In key feeding and roosting areas, it is common to see several eagles perched in the same tree.

Fast Fact: In Bear Valley in south-central Oregon, more than 300 bald eagles have been seen roosting in the same stand of trees at one time.

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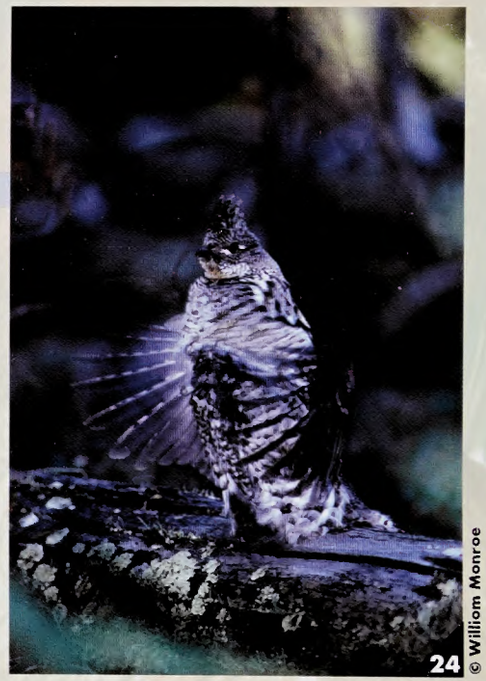
One way woodpeckers communicate is by using their bills as a hammer to drum and tap on snags. Woodpeckers drum during courtship to announce their territories and ward off other competing woodpeckers. Some woodpecker species can be identified by the different patterns and sounds of their drumming.

Some grouse use down logs for courtship displays. Here is a ruffed grouse using a log as a stage to "drum" upon. When a male grouse drums, it beats its cupped wings back and forth in the air, producing a muffled drumroll-like sound. Like the woodpeckers, they do this to announce their territory, attract females, and keep other males away.



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Environmental Education Programs

There are a variety of other trees besides snags and down logs that are used by wildlife. For example, live trees that are infected with a heart rot fungus allow wildlife to use them like snags. Some woodpeckers use live trees with decayed heartwood because they can drill through the hard outer layer of sapwood and excavate the nest chamber in the softened heartwood. These live trees with decay inside usually last longer than snags and can give wildlife many years of nesting use.

Fast Fact: Red-naped sapsuckers prefer to nest in live aspen trees that are decaying inside rather than snags.

Some woodpeckers even take advantage of the sap in trees as a good source of carbohydrates. This is a juvenile red-naped sapsucker. They drill evenly spaced rows in the tender bark of live trees and eat the soft layer of wood just under the bark called cambium.

Sap oozes from these holes and will be lapped up by the woodpecker with its specially designed tongue. In addition, insects are attracted to the sticky sap and they are eaten as well. Hummingbirds are known to visit and feed from these sap wells.

Large old-growth trees also provide habitat for wildlife. Bald eagles build large nests in these trees and usually use the same nest year after year. Each year eagles will add more material to their existing nest, making it larger and heavier. These nests may be 8 feet across and 12 feet deep. These large, heavy nests require old-growth type trees with large strong branches to support them.

In general, the larger the tree, the more useful it is for wildlife. It takes a large tree to make a hollow chamber for an animal like a bear to crawl in or a pileated woodpecker to nest or roost in. Large trees can be used by small animals, but large animals cannot fit into smaller trees. Large trees and snags last longer and can give wildlife more years of use than smaller ones.

Fast Fact: To nest, the northern flicker needs a tree that is at least 12 inches in diameter at breast height, which is about4-1/2 feet off the ground, and the pileated woodpecker needs a tree that is at least 20 inches diameter at breast height.

29
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30
Photo by Mike Small, BLM

Because people use wood products, we have destroyed many snag and log habitats. Logging is one of the obvious ways people impact these habitats. Forest workers often have to cut snags down because they are unsafe to work around, which leaves few (if any) snags for wildlife.

31
© William Bonosszewski

Firewood cutters will often cut snags because they are dry and ready to burn.

32
Photo by William Deon, BLM

Currently, federal land management agencies, like the Bureau of Land Management, have requirements to keep some live trees, snags, and down logs in areas after trees are harvested. For example, in Oregon, the BLM is required to keep some live trees, snags, and down logs on every acre they harvest for the benefit of a variety of wildlife species.

Environmental Education Programs

Photo by William Dean, BLM

33

In areas where past timber harvests have removed most snags and down logs, the BLM creates wildlife trees to improve habitat for all the species that need snags and down logs. There are a number of ways biologists create wildlife trees. The most dramatic way is to use dynamite and blow off the top of a live tree in order to kill the tree and begin the decaying process.

Biologists like this method because it creates a jagged edge on the top where water collects and encourages decay to start.

34

© Barry Schreiber

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36

Cutting off the top of a tree using a chainsaw is another popular way to create snags. This method is quicker and less expensive, but it doesn't create the jagged edge effect.

In addition, snag substitutes can be created. Osprey are known for building nests on top of snags. Osprey will readily nest atop artificial nesting poles placed in proper habitat.

35

Photo by Greg Miller, BLM

Another popular way people help cavity-dependent wildlife is by putting up nest boxes. Nest boxes are often helpful for monitoring populations and enhancing habitats where natural nest cavities are in short supply. Nest boxes can be built to exact specifications so they are optimal for a specific species.

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38

Placed in the proper habitat, artificial boxes are readily used by numerous species of birds. Nest boxes are made for a variety of wildlife, such as swallows, bluebirds, wood ducks, and owls. However, nest boxes are not complete substitutes for snags since they can only replace a few of the many functions that standing dead trees provide for wildlife.

Nest boxes are convenient for researchers because they can control the conditions and easily get to the nest inside for banding and collecting monitoring data. Here a biologist removes an adult tree swallow to place an aluminum band on her leg. Each band has a unique number so this bird can be identified every time it is recaptured. One thing scientists have learned is that birds tend to return to the same area, or even the same nest box, year after year.

Enrichment: List several ways that wildlife species can use snags but can't use nest boxes.

We have talked about primary cavity nesters like woodpeckers and how some use hard snags and others use soft snags for nesting, feeding, and shelter during bad weather.

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We have also learned about animals that benefit from the woodpeckers' activity. These are called secondary cavity nesters. These animals can't create holes or cavities, so they depend on the woodpeckers and other natural processes for their nest or den sites.

Additionally, we discovered that down logs provide habitats important to wildlife. Down logs provide food, shelter, and breeding habitats. Some of the same animals that use snags also use down logs, but there are other wildlife that benefit more from down logs.

Photo collage (see slide key for photo credits)

Photo collage (see slide key for photo credits)

Wildlife use snags and down logs in a variety of other ways as well, such as for hunting perches, roosting and hibernating sites, and places for courtship and territorial displays.

Fast Fact: In the Columbia River Basin (parts of Oregon, Washington, Idaho, and western Montana), there are over 80 species of birds, mammals, reptiles, and amphibians that use "wildlife trees" including snags, logs, and live trees with heart rot and other diseases.

Whether they are standing up, lying on the ground, or sitting in the water, trees provide important food, shelter, and a variety of other uses for wildlife.

And remember, a healthy forest contains dead and dying trees as well as live ones. To manage properly for all of our wildlife, we need to maintain or create all of the habitats that are found in a natural system.

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Presentation for Grades 5-8

1 Today we are going to talk about the many ways animals use trees. For several wildlife species, having dead trees in the forest is as important as having live ones. We'll also talk about how some live trees provide unique conditions that are useful to wildlife. Then we'll explore how forest management can reduce the amount of trees and logs available to wildlife and what can be done to lessen that impact.

2 We all know that trees are important to people. Trees give us lumber to build homes, paper to create books, shade for our yards, and forests where we can hike and enjoy nature. But trees are important to many wild animals as well. Living or dead, trees are a vital part of our natural environment.

3 When you are in a forest or near a river or stream, you may see standing dead trees with just a few branches. They are often rotted with holes and the bark may be loose or have fallen away. Often the top is broken off. These standing dead trees are called "snags."

4 Trees that have died and fallen to the ground are called "down logs" or "coarse woody debris."

5 Many species of wildlife need snags and down logs to survive, from small, seldom-seen, wood-boring beetles to larger, well-known woodpeckers. Wildlife use dead and dying trees for food, homes, and other needs.

Fast Fact: Snags can be separated into two groups: hard and soft. This grouping is important to wildlife biologists because some bird species can excavate nest cavities only in soft wood. For example, Lewis' and downy woodpeckers and white-breasted and red-breasted nuthatches prefer soft snags, and black-backed, pileated, and hairy woodpeckers prefer hard snags for nesting. Soft snags also provide food and shelter for invertebrates, like insects, on which many kinds of wildlife feed.

6 Woodpeckers often drill nest holes in the decayed wood of snags. These holes are called cavities. Nesting inside a cavity provides protection against predators. Most animals use nesting holes that are no larger around than they are, which keeps larger predators out.

Fast Fact: Some birds nest in cavities created in soil instead of wood. Belted kingfishers, bank swallows, and Atlantic puffins are a few examples.

7 Woodpeckers have straight, hard, pointed bills that they use as a chisel to peck into trees. They do this to feed on insects as well as to make holes.

8 Woodpeckers have extraordinarily long tongues that they use to reach insects deep in holes and crevices. Their tongues are sticky and have barbs. They also have a spearlike tip to help them catch prey. Here is a juvenile northern flicker learning to use its tongue.

9 Some animals that use holes to nest or rest in cannot make the holes themselves. This bluebird must use holes made by woodpeckers or find a tree that has become hollow due to age.

Fast Fact: House sparrows and European starlings are two birds that were introduced to North America from Europe. Both birds have spread over much of the continent and compete with native species for cavities to nest in. This competition can impact the survival of North American birds.

Environmental Education Programs

11 Live trees and snags that break in half during windstorms are also useful to owls such as this great gray owl. Great gray and northern spotted owls are known for using trees that have broken tops, a bowl-shaped hollow in the middle, and some wood and bark up the sides. These snags help protect the owls from rain, snow, and wind.

12 Small mammals such as the northern flying squirrel use holes in snags all year long for cover and to store food.

Fast Fact: The northern flying squirrel does not really fly, but glides from one tree to another on flaps of skin that extend between its front and rear legs. From a height of 60 feet, a flying squirrel can glide more than 160 feet.

15 When an animal such as a chipmunk stores a lot of food, it is called a cache. Rodents and other animals use snags to cache food for winter or early spring when food is scarce.

13 When the bark of dead trees becomes loose, lots of creatures benefit from the new space that is created between the bark and the tree. During the summer, bats roost under the loose bark.

16 When snags and live trees fall to the ground, they continue to provide homes for wildlife like frogs, salamanders, mice, and rabbits.

18 Lynx will den in areas with many down logs that provide good hiding places for their young (kits).

21 Logs that have fallen into the water provide excellent hiding places for fish and resting spots for waterfowl and turtles. Turtles need to warm themselves (bask) in the sunlight to keep their bodies at the right temperature.

22 Wildlife also use trees, snags, and logs to communicate. Eagles can quickly spot each other on exposed branches, which makes it easier for them to find mates. Eagles often choose dead trees to perch, which provide enough room for their 7-1/2-foot wingspans.

Fast Fact: In Bear Valley in south-central Oregon, more than 300 bald eagles have been seen roosting in the same stand of trees at one time.

24 Here is a ruffed grouse using a log as a stage to "drum" upon. When a male grouse drums, it beats its cupped wings back and forth in the air, producing a muffled drumroll-like sound. They do this to announce their territory, attract females, and keep other males away.

25 There are a variety of other trees besides snags and down logs that are used by wildlife. Some woodpeckers use live trees that have a fungus growing inside them. They can drill through the hard outer layer of wood and easily make their nests in the softened heartwood. These live trees with decay inside usually last longer than snags and can give wildlife many years of nesting use.

Fast Fact: Red-naped sapsuckers prefer to nest in live aspen trees that are decaying inside rather than snags.

28 Large old-growth trees also provide habitat for wildlife. Bald eagles build large nests in these trees and usually use the same nest year after year. These nests may be 8 feet across and 12 feet deep. Only large, strong trees can hold these huge nests.

29 In general, the larger the tree, the more useful it is for wildlife. It takes a large tree to make a hollow chamber for an animal like a bear to crawl in or a pileated woodpecker to nest or roost in. Large trees can be used by small animals, but large animals cannot fit into smaller trees. Large trees and snags also last longer than smaller ones.

Fast Fact: To nest, the northern flicker needs a tree that is at least 12 inches in diameter at breast height, which is about 4-1/2 feet off the ground, and the pileated woodpecker needs a tree that is at least 20 inches diameter at breast height.

30 Because people use wood products, we have destroyed many snags and logs. Forest workers often have to cut snags down because they are unsafe to work around, which leaves few (if any) snags for wildlife.

31 Snags are often dry and easy to burn, so firewood cutters will often cut them first.

32 Federal land management agencies, like the Bureau of Land Management, have requirements to keep some live trees, snags, and down logs in areas after trees are harvested.

33 Snags and down logs can be created in areas where there are not enough for the animals that need them. One way to create a snag is by using dynamite to blow the top off a tree.

35 Cutting off the top of a tree using a chainsaw is another popular way to create snags.

36 Sometimes biologists will build structures to help take the place of dead trees. Osprey will nest on top of poles placed near water.

37 Another popular way to help cavity-dependent wildlife is by putting up nest boxes.

38 Nest boxes need to be the right size and in the right place. They are made for a variety of wildlife, such as swallows, bluebirds, wood ducks, and owls.

39 Nest boxes allow researchers to easily study the nest inside. Here a biologist removes an adult tree swallow to place an aluminum band on her leg. Each band has a unique number so this bird can be identified every time it is recaptured. It takes special training for a biologist to do this. Anyone else should leave nests alone for the safety of the birds.

Enrichment: List several ways that wildlife species can use snags but can't use nest boxes.

40 We have talked about the importance of snags and how animals like woodpeckers make their own holes in trees. They use snags for nesting, feeding, and shelter during bad weather.

41 We have also learned about animals that benefit from the woodpeckers' activity. These animals can't create holes or cavities, so they depend on the woodpeckers and other natural processes for their nest or den sites.

42 Additionally, we discovered that down logs are important to wildlife. Down logs provide shelter and a place to find food.

43 Wildlife use snags and down logs in a variety of other ways as well, such as for hunting perches, roosting and hibernating sites, and places for courtship and territorial displays.

Fast Fact: In the Columbia River Basin (parts of Oregon, Washington, Idaho, and western Montana), there are over 80 species of birds, mammals, reptiles, and amphibians that use "wildlife trees" including snags, logs, and live trees with heart rot and other diseases.

44 Whether they are standing up, lying on the ground, or sitting in the water, trees provide important food, shelter, and a variety of other uses for wildlife.

45 And remember, a healthy forest contains dead and dying trees as well as live ones.

John Van Niel

Presentation for Grades K-4

1 Today we are going to talk about trees.

2 Trees are important to people. Trees give us wood, paper, and shade.

41 Animals also need trees. Trees give them food, homes, and shelter. Animals need both living and dead trees.

3 Dead trees that have a few branches and are still standing are called "snags."

4 Dead trees that have fallen to the ground are called "down logs."

5 Many animals, such as beetles and woodpeckers, need snags and down logs to survive.

6 Some animals, such as woodpeckers, make holes in snags for their nests. These small holes keep the nests safe from other animals.

8 Woodpeckers also find food in snags. They have long, sticky tongues that can reach insects deep in the holes.

9 Some animals cannot make holes themselves. They use holes made by woodpeckers or find trees that are hollow.

11 Owls sometimes use hollow trees with broken tops to protect them from rain, snow, and wind.

12 Northern flying squirrels use holes to hide their food.

15 Chipmunks and other animals store food in snags for winter and early spring.

13 Some animals, such as bats, rest in the space between a snag and its loose bark.

16 Down logs provide homes for frogs, salamanders, mice, rabbits, and other wildlife.

18 Lynx and their babies like to hide in places with many down logs.

21 Logs that have fallen in the water make good hiding places for fish. They also make good resting places for birds. Turtles like to warm themselves in the sun on these logs.

22 Snags and down logs make it easy for animals to "talk" to each other. Eagles can easily sit or "perch" in the tops of large snags. Then they can quickly spot each other.

24 Male ruffed grouse use logs as a stage. They beat their wings back and forth and make a sound like a drumroll. This is how they mark their space, attract females, and keep other males away.

25 Wildlife also use other kinds of trees besides snags and down logs. Some use live trees that are rotting on the inside. Woodpeckers can drill through the hard outside layer and nest in the soft inner wood.

28 Bald eagles build huge nests in large, old trees that are strong enough to hold them.

29 Large trees can be used by more kinds of animals than small trees.

31 Sometimes snags are cut down for firewood. Down logs are often hauled off so their wood can be used in other ways.

32 In places where trees are cut down, we need to keep some live trees as well as some snags and down logs.

33 If too many snags are removed, more can be made by blowing the tops off of trees with dynamite.

Environmental Education Programs

35 They can also be made by cutting the tops off with a chainsaw.

36 Sometimes something can be built in place of dead trees. Osprey will nest on top of poles placed near water.

38 Nest boxes can also help animals. If nest boxes are the right size and in the right place, swallows, bluebirds, wood ducks, and owls, will use them.

44 Whether they are standing up, lying on the ground, or sitting in water, trees are important to wildlife for food, shelter, nesting, and other uses.

45 And remember, a healthy forest contains dead and dying trees as well as live ones.

Extension Activities

Campus Habitat Walk (Grades K-4, 5-8, 9-12)

Objective: Students will evaluate their school grounds for the presence of or potential for wildlife trees, snags, and down logs.

Materials: None needed, but a tape that measures diameter at breast height and an increment borer are appropriate.

Background: This activity will provide students with the opportunity to view trees firsthand with a biologist and assess the value of the trees to wildlife. In addition, students can brainstorm potential areas where wildlife habitat can be increased on their campus.

Method: With the help of the classroom teacher, take the students out onto their school grounds with the intention of assessing the property for wildlife trees, snags, and logs and their value to wildlife. With many schools in urban and suburban settings, insect value may be the most common! As you proceed through campus, evaluate areas where habitat could be increased through the addition of down woody material or nest boxes. Allow students to assist in measuring trees and encourage the class to consider adopting some of the suggestions you come up with to increase wildlife habitat.

Environmental Education Programs

The Ultimate Wildlife Tree (Grades K-4, 5-8)

Objective: Students will create a wildlife tree that displays several ways animals use trees.

Materials: Large paper, colored pencils, crayons or paint, "BLM wildlife tree" sign.

Background: A single tree can provide numerous benefits to wildlife. This activity will reinforce the concepts covered during the slide presentation by having students design a tree that has multiple benefits to wildlife.

Method: Students can work individually or you can divide the class into teams of two to four individuals. Explain that each team is responsible for creating the "ultimate" wildlife tree. Review the benefits trees have for wildlife by listing them on the board. Ask that each group plan out their tree on a small sheet of paper before construction begins on the large sheets.

You may wish to assign groups specific trees to produce (live, snag, down log) or allow them the latitude to create whatever they wish. Older classes should be able to label the tree with terms used in the presentation (cavity, softened heartwood, etc.). Students could even cut pictures of wildlife using trees from old magazines to add to their drawings. Finally, provide a BLM wildlife tree sign (or a photocopy) as a model for students to reproduce on their tree. Now each tree is protected!

WILDLIFE TREE
DO NOT DISTURB
Many birds and animals use trees and snags for perching, nesting, denning, and as a food source. As a necessary part of wildlife habitat, this tree is reserved from cutting. Do not cut or damage it. Violators will be prosecuted according to the provisions of 18 U.S.C. Sec. 1853.
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Cavity Nesting Birds (Grades 9-12)

Objective: Students will research the needs of cavity-nesting birds.

Materials: Reference materials, paper, scissors.

Background: As explained in the presentation, cavity-nesting birds require trees and snags of the proper size in order to nest. Large birds require large, older trees. This activity really allows students the opportunity to see that not all trees are of equal value to wildlife.

Method: Divide the class into groups of two to three students. Assign each group a cavity-nesting bird. Ask them to research the specific nesting habits of the bird, including the minimum diameter of a tree that they would be able to use for nesting. If that information cannot be found, work with the students to deduce a reasonable answer based on the size of the bird. Published information on birdhouse dimensions can also be of help.

The final step of the project is to cut a circle out of paper to represent the minimum diameter of a tree your species would need for nesting. Incorporate the cutout into a report for display. Display all projects with pictures of the various birds.

Environmental Education Programs

KidsArt* (Grades K-4, 5-8, 9-12)

Objective: Students will use art to express the concepts presented in the wildlife trees presentation.

Materials: High-quality art materials (watercolors, 22"x15" watercolor paper, and paintbrushes), picture frames, mats, and hangers.

Background: In 1991, the Eugene District of the Bureau of Land Management and the 4-J School District formed a business/education partnership. This project provided students with an opportunity to gain a better understanding of the BLM, natural resources, and land management in conjunction with the experience of having their artwork professionally displayed in a public building.

The Eugene District Office created the KidsArt* Program as a way for the BLM to decorate the office with art at a low cost and at the same time reach out to the people who are going to benefit most from resource management.

Additional objectives of the program are to reach out and bring the community into the BLM, to assist in the education of students in the community, and to have the BLM office atmosphere reflect the community and environment in which the organization works.

Method: There are a number of ways to run this activity. The following method worked well in Eugene:

Give a presentation to the class and then explain to the students that they will be doing a project in which they will paint a scene depicting one or more of the natural resources themes discussed during the presentation. Provide the students with handouts, brochures, and any other pertinent information on the subject. Give the students several days to review the materials and develop their ideas.

Recruit an art teacher from the school or a local artist to work with you on your next visit. Have the artist present some basic painting and design techniques to the class. Work with the students, providing general guidance and encouragement, through the development of their paintings.

Mat and frame the artwork once it is completed. Display the artwork in the office conference rooms and hallways for employees and the public to enjoy. You can invite the students to the office to see their artwork and to tour the office. The Eugene District rotates this artwork every 3 months with other artwork displays.

* Bill Gilmore, Doug Huntington, and Jean Nelson-Dean first developed this program in the Bureau of Land Management's Eugene District in Oregon.

Wildlife Trees

The Value of Snags and Down Logs

The Wildlife Investigator Series

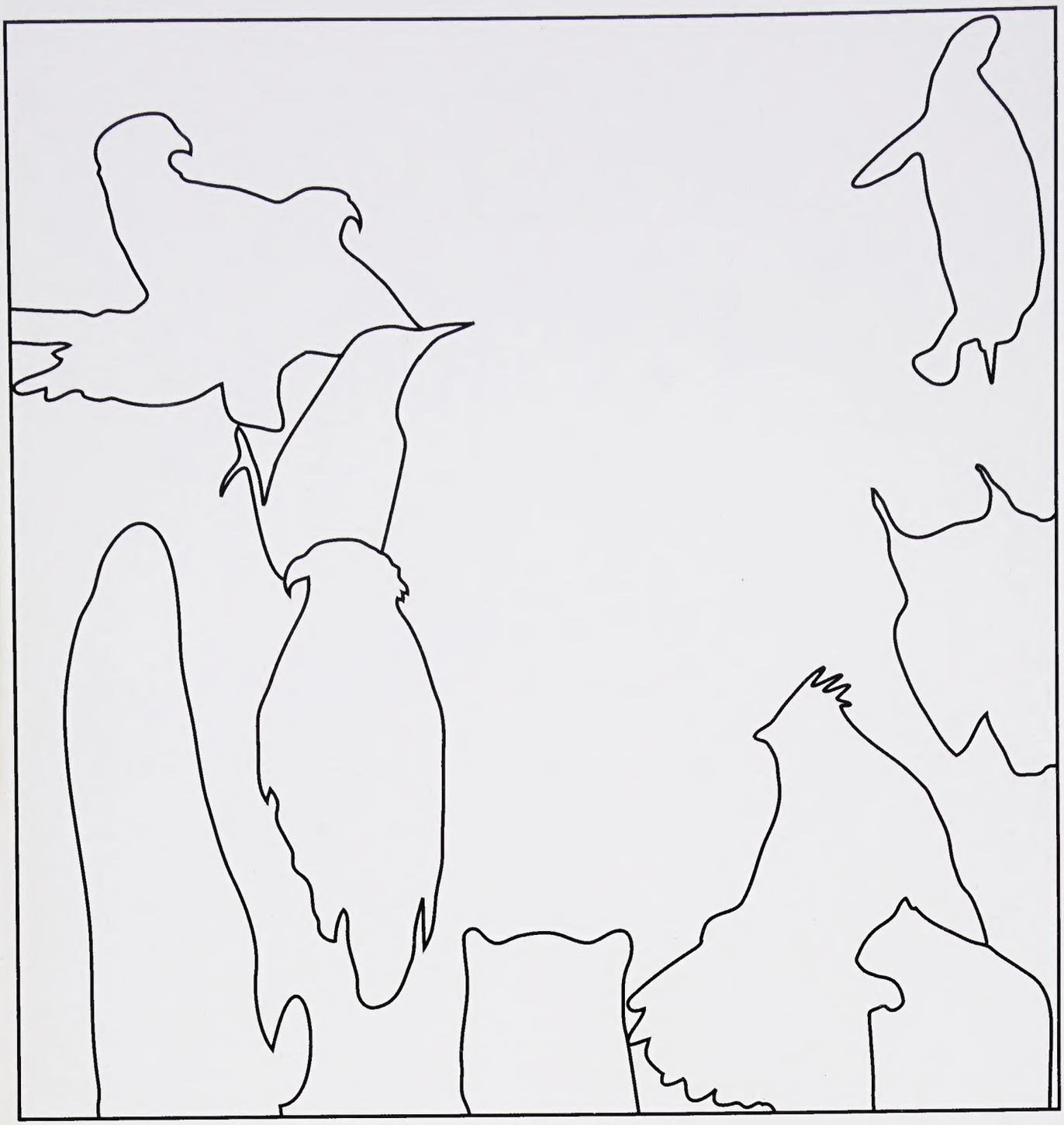
Environmental Education Programs

Find the hidden animals. The animals pictured at right use snags and down logs for nesting, feeding, perching, and shelter. See if you can find these animals in the picture above.

Photo Credits: W. Banaszewski, M.Burcham, W. Monroe, S. Sherman, J. Van Niel

U.S. Department of the Interior
Bureau of Land Management

Poster Key



Wildlife Trees Poster Key

Above are the outlines of the animals where they appear in the photo.

Wildlife Biologists

A Day in the Field

Wildlife Biologists—A Day in the Field

National Science Education Standards

The presentations and accompanying activities for this topic align with the following National Science Education Standards:

Grades 9-12

- Content Standard A: Science as Inquiry (abilities necessary to do scientific inquiry, understandings about scientific inquiry)
- Content Standard C: Life Science (interdependence of organisms)
- Content Standard F: Science in Personal and Social Perspectives (natural resources; natural and human-induced hazards; science and technology in local, national, and global challenges)
- Content Standard G: History and Nature of Science (science as a human endeavor, nature of scientific knowledge)

Grades 5-8

- Content Standard A: Science as Inquiry (abilities necessary to do scientific inquiry, understandings about scientific inquiry)
- Content Standard C: Life Science (populations and ecosystems, diversity and adaptations of organisms)
- Content Standard F: Science in Personal and Social Perspectives (natural hazards)
- Content Standard G: History and Nature of Science (science as a human endeavor, nature of science)

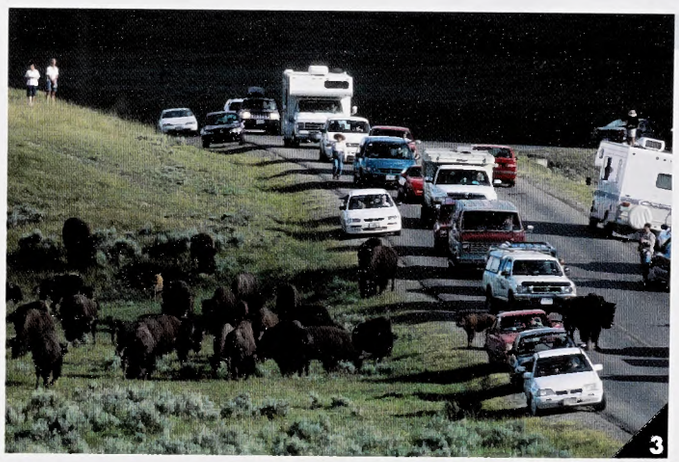
Grades K-4

- Content Standard A: Science as Inquiry (abilities necessary to do scientific inquiry, understandings about scientific inquiry)
- Content Standard C: Life Science (characteristics of organisms, organisms and environments)
- Content Standard F: Science in Personal and Social Perspectives (changes in environments)

Presentation for Grades 9-12

Today we are going to see what it's like to spend a day "in the field" with a wildlife biologist. "In the field" can mean two things. It can mean where these biologists work—outdoors in the field—or it can mean their career field or profession—the field of wildlife biology. We will explore three different types of wildlife work: managing habitats or the places where animals live; managing populations or how many animals there are in an area; and researching wildlife. We will also compare biologists of the past and those of the present.

The diverse wildlife in the United States is one of our most important and visible natural resources. People have always depended on wildlife for food, clothing, and shelter. For example, American Indians who lived in what currently is called the Midwest or the Plains used bison for food, shelter, clothing, games, and religious practices for thousands of years.



© Milo Burchom

Today, people still rely on wildlife. Although some people still hunt wild animals for food, our greatest direct benefit from wildlife is enjoyment. Millions of dollars are spent every year to watch and photograph wildlife.

Wildlife biologists lead the effort to maintain healthy ecosystems that will sustain an abundance and diversity of wildlife.

Photo collage (see slide key for photo credits)

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5

One way biologists sustain wildlife is through habitat management. Habitat is the place where an animal lives and finds food, water, and shelter. Biologists manage habitats to improve their condition and to decrease the negative impacts from human activities. They can change the habitat in an area to make it more attractive for certain animals.

Fast Fact: Many wildlife professionals feel that habitat is the most important factor for managing wildlife populations. Without good quality habitats, wildlife would have no place to live.

Wildlife habitats can be greatly changed by fire. Fire is a natural part of the environment. It is most often caused by lightning. Historically, in the West, wildfires were allowed to burn more frequently than they are today. By not allowing fires to burn, plant communities have grown into unnatural and unhealthy conditions in these habitats.

6

Photo by Jean Nelson-Dean, BLM

Photo by Govin Lovell, BLM

7

Habitat biologists sometimes work with fire management specialists to restore and maintain healthy plant communities. They use prescribed fire to improve grassland, shrubland, and open woodland habitats.

A change in the type of plants in an area can determine which animals will use it. Some wildlife, like golden eagles, live in grasslands and open woodlands. If there are too many trees and shrubs, it is harder for them to catch jackrabbits and ground squirrels. Habitat biologists use fire to stop trees and shrubs from growing.

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9

Natural fires appear to burn complete forests, but they also leave patches of live trees. This mix of old and new habitat provides homes for different kinds of animals.

Black-backed woodpeckers benefit from forest fires because they feed on bark beetles that come to feed on the dying trees. These woodpeckers and other wildlife also nest or den in dead trees.

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10

Another way to manage habitat is to use forestry practices, such as logging, to control the growth and diversity of trees. Logging also provides jobs and contributes money to local communities, and when done with care, it can maintain or enhance suitable habitat conditions for wildlife.

© Gary Leppart
8

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11

Environmental Education Programs

Photo by William Dean, BLM 12

To lessen the impacts of logging, habitat biologists work with foresters to keep some of the largest trees, snags, and down logs in areas that are being logged. These trees provide hunting perches for raptors, nesting and foraging opportunities for woodpeckers, organic matter for soil development, and structure for the new forest.

In logging units that have few, if any, snags, biologists create wildlife trees by blasting or cutting the tops off with chainsaws. Many animals depend on dead trees and logs for food, cover, and breeding.

13 Photo by William Dean, BLM

When nest trees are scarce, nest sites can be created for birds like osprey by putting a platform on top of a pole.

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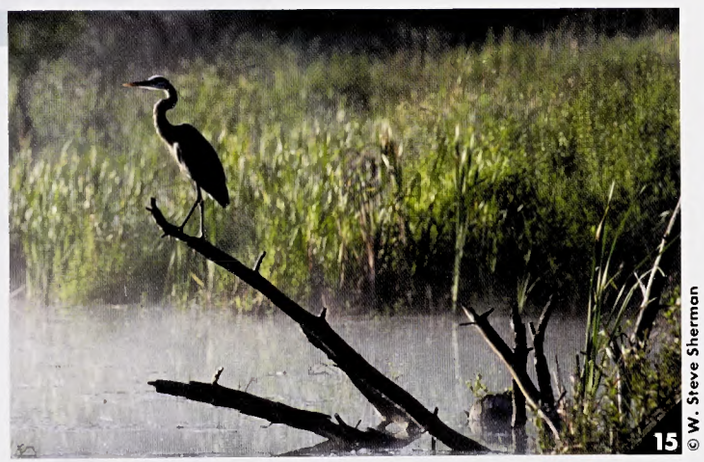
Managing wetlands and riparian areas along rivers and streams is a top priority for habitat biologists. These areas provide diverse habitat for a multitude of wildlife species. However, they are popular spots for people and livestock as well.



15 © W. Steve Sherman

Many wetlands have been lost to human development. Habitat biologists look for opportunities to create wetlands and sometimes work with explosives experts to create ponds.

Photo by Jim Roscoe, BLM
17

The ponds provide open water for waterfowl to feed and rest, foraging habitats for great blue herons, and yearlong breeding and cover areas for amphibians.

Habitat biologists often work with partners, such as ranchers or Ducks Unlimited, to restore rivers that were rerouted and wetlands that were drained for farming and livestock grazing. Heavy equipment sometimes is needed to block off the human-made drainage ditches and reroute water to the old river channel. Wetland plants are often grown and transplanted at the site to help stabilize the river's new bank. This project adds river riparian habitats and marshy wetlands that provide homes, food, and water for wildlife.

Photo by Jim Roscoe, BLM
16

Photo by Wedge Watkins, BLM
18

© Milo Burchom
19

If wetland and riparian habitats are not properly managed, cattle and people can remove important grass, shrub, and tree cover that provides breeding and foraging habitats for amphibians and songbirds.

SKULLS, ANTLERS, and HORNS
Understanding the Natural History of Animals
WILDLIFE TREES
The Value of Snags and Down Logs
WILDLIFE BIOLOGISTS
A Day in the Field

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Working with range conservationists and ranchers, habitat biologists can create riparian pastures, develop special grazing systems, and maintain healthy riparian areas. Here a yellow warbler is nesting, as they often do, in a healthy riparian area.

Habitat biologists also maintain good-quality habitat by lessening impacts from human activities. Managing habitat may involve keeping people out of areas that are needed by wildlife. Biologists regularly close roads, either temporarily or permanently, around habitats when wildlife may be bothered by vehicle traffic.

© Milo Burchom

Photo by Jim Nielond, USDA Forest Service

Bat caves are sometimes closed to humans because some bats, such as the Townsend's big-eared bat, are very sensitive to human disturbance. If bats are disturbed during hibernation, they may use their last energy reserves to wake up—only to find no insects available—and then possibly die of starvation.

Fast Fact: Most female bats give birth to one pup per year and raise it with other mothers in a nursery colony. Bats are generally long-lived animals. Some live 30 or more years.

© William Monroe

Another type of work that biologists do involves managing wildlife populations. To manage wildlife populations, biologists study the size and health of specific groups of animals.

Counting the number of animals in an area is necessary to understand the condition of that population. The number of females and males, the ages of individuals, and how well the animals are reproducing are all important pieces of information for population management.

Photo by William Dean, BLM
25

One of the best known aspects of population management involves hunted species. For hunted wildlife, population numbers are used to set harvest levels, season dates, and special regulations. Game check stations help biologists collect harvest data and keep in touch with hunter interests. It is important for hunters to stop at check stations so biologists have enough information to make good decisions.

Fast Fact: Hunting groups in the United States have contributed significantly to wildlife conservation. When wildlife populations began to disappear from overharvesting, hunters, such as Teddy Roosevelt, helped establish laws and conservation groups to recover populations and protect habitats.

Before harvest levels were established, overhunting dangerously reduced many wildlife populations. Now, habitat loss and disease are the two major problems challenging population biologists. This Rocky Mountain bighorn sheep died from a condition called the lungworm/pneumonia complex.

Fast fact: Some biologists believe that stress, caused by high population numbers and decreased habitat quality, increases the chance of lungworm outbreaks that make the sheep more vulnerable to catching pneumonia.

24
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Photo by Craig Fager, Montana Department of Fish, Wildlife, and Parks
26

Environmental Education Programs

Photo by William Deon, BLM

27

When populations are too small, biologists may bring in animals from another healthier population. Of course, they first study the condition of the local habitat to be sure the animals will do well in their new home.

Population biologists must also deal with problems between people and wildlife. For example, beavers sometimes build dams that flood roads and people's property. Beavers can be trapped and relocated to areas where they won't cause problems for humans.

28

© William Bonoszewski

Photo by David Nelson, USDA

29

Grizzly bears and gray wolves sometimes prey on ranchers' livestock. By looking at the wounds, biologists are able to identify what predator made the attack. Where the animal was bitten, the distance between the canine teeth, and what the predator did with the carcass after feeding are clues biologists use to identify the predator.

Fast Fact: When wolves attack larger sized prey, such as calves and yearling cows, they typically attack the outside shoulders, the webbing in the armpit, and the hindquarters and rectum areas. Grizzly bears, however, usually go for the area along the top of the back and between the shoulder blades. Mountain lions generally bite at the base of the skull and top of the neck, while coyotes often go for the throat area. Mountain lions and coyotes typically prey on smaller animals than wolves and grizzly bears. Wolves usually clean a carcass completely, but other predators don't. Grizzly bears and mountain lions may return later to feed. Grizzly bears tend to bury their leftovers, while mountain lions will just cover them with debris.

Photo by David Nelson, USDA

30

When an animal attacks livestock, it is trapped using a leg-hold snare, taken to an area far from people, and released. If the same animal continues to feed on domestic livestock, it may have to be destroyed or placed in a zoo.

Fast Fact: Bears are often perceived as meat-eaters. However, grizzly and black bears are omnivores, which means they eat both plants and animals. Plants, such as grasses, berries, nuts, fruit, roots, and tubers, can make up over 75 percent of a bear's diet, depending on where it lives.

Another well-known aspect of population management involves wildlife species that are in danger of becoming extinct because of human demands or environmental damage to their habitats. Population management biologists track wildlife species declines and possible extinctions.

For example, biologists found that every year there were fewer northern spotted owls because too many trees in the forests where they live were being cut. The owls were listed as a threatened species. Biologists continue to keep a careful watch on these owls to make sure they remain a part of our natural world.

© Milo Burchom
33

Bald eagles almost became extinct because of an insecticide called DDT. Although this chemical was used to kill insects, it also hurt species that ate the insects. Eagles and other birds began to lay eggs with thin eggshells that broke from the birds' weight during incubation. However, because of the tracking of these declines and proper management, the use of DDT was stopped in the United States before it was too late. Bald eagles are doing well now and are returning to areas where they have not nested in years.

Though habitat and population biologists have important jobs managing for wildlife, researchers play an equally important role. Researchers contribute to habitat management by studying what makes a wildlife species' habitat and how species use different parts of their habitats. Researchers contribute to population management by studying how individual species and groups of species function and what roles they play in the ecosystem.

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31

Photo by Joseph Lint, BLM
32

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34

Environmental Education Programs

WILDLIFE BIOLOGISTS
A Day in the Field

WILDLIFE TREES
The Value of Snags and Down Logs

SKULLS, ANTLERS, and HORNS
Understanding the Natural History of Animals

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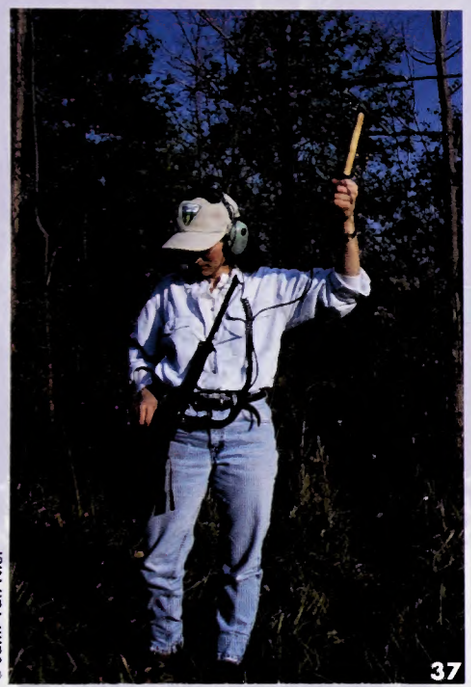
35

Researchers study wildlife populations in many ways. One method is to individually mark animals so they can be identified if they are caught again. This Virginia rail has had an aluminum band with a unique number placed on its leg. If this bird is caught again by a researcher or found by any person, it can be traced back to the date and place it was originally captured. Biologists use this information for population counts and to determine the size of the bird's range.

Larger birds, like this swan, can be fitted with a wing tag. The large size of the tag allows a biologist to read it from a distance without ever catching the bird again. This allows for numerous sightings of this individual, which provides valuable information on the life history of the bird and the species in general.

36 © John Van Niel



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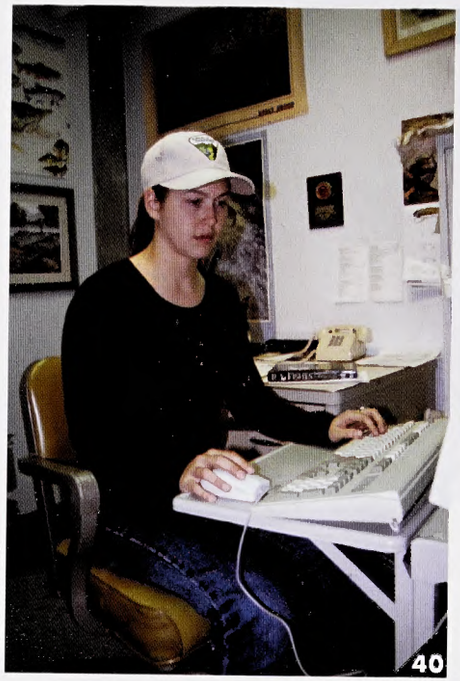
37

In addition to using numbered tags or bands, biologists can tag wildlife with devices that transmit radio waves. Biologists use a receiver and antenna to locate the animal again. This gives biologists information about the behavior and movements of animals that are shy or secretive.

This use of technology illustrates how much the field of wildlife biology has changed over the years. As knowledge of wildlife and the tools available have become more sophisticated, the work of present-day biologists has become significantly different than the work of wildlife biologists of the past.

38 © John Van Niel

Historically, biologists were pioneers in a new and vast field, discovering new species and developing understandings of relationships. With the invention of television, biologists captured our imagination and drew us into their careers. However, these biologists usually focused on just a few species with specific goals. They often worked alone in remote areas, which required strong field skills. For the most part, the outdoors was their office and they had little public interaction.


© John Von Niel
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But this popular view of wildlife biologists working directly with wild animals, handling and tracking them while working in beautiful and wild areas, is only partly true. Today's biologists also spend time in an office environment. The office is an important place where they spend time working on computers, conducting library research, networking with colleagues, and talking with the public.

Modern biologists need training in more than just plant and wildlife ecology. Biologists must know laws, economics, and how to work with the public. They must develop complex management approaches that help many wildlife species, not just a single species, and be able to "sell" those approaches to managers and the public. Biologists, to be effective, must consider the human factor in everything they do.

Biologists have many different kinds of responsibilities. Today we have talked about how wildlife biologists are involved in habitat and population management and research.

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39

Photo by Lisa Lewis, USDA Forest Service
41

Photo collage (see slide key for photo credits)
42

SKULLS, ANTLERS, and HORNS
Understanding the Natural History of Animals
WILDLIFE TREES
The Value of Snags and Down Logs
WILDLIFE BIOLOGISTS
A Day in the Field

Environmental Education Programs

Photo collage (see slide key for photo credits)

43

Photo collage (see slide key for photo credits)

45

In habitat management, biologists improve and restore habitat conditions, create habitat features that are missing, and lessen (mitigate) impacts from human activities.

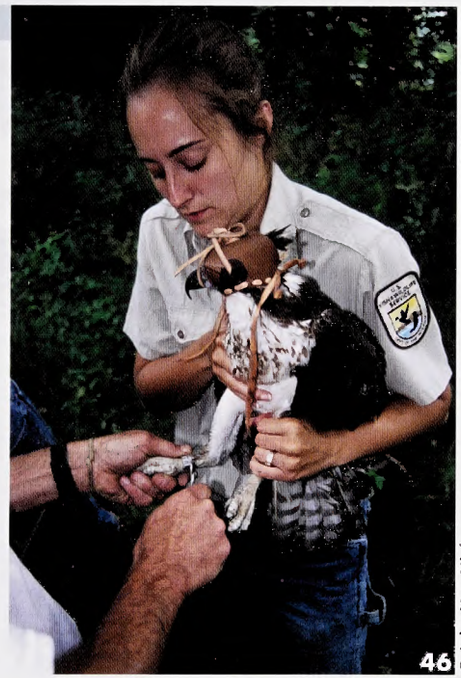
In population management, biologists maintain populations, such as big game, for hunting, increase populations of threatened and endangered species, and remove problem animals.

Photo collage (see slide key for photo credits)

44

Biologists also conduct and use research to better understand and more effectively manage wildlife and their habitats.

Many types of biologists spend their days "in the field," and by working together, these professionals keep both the wildlife and the places they live healthy for now and the future. If you are interested in wildlife, perhaps you will make the field of wildlife biology a part of your future.



46

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Presentation for Grades 5-8

1 Today we are going to see what it's like to spend a day "in the field" with a wildlife biologist. "In the field" can mean two things. It can mean where these biologists work—outdoors in the field—or it can mean their career field or profession—the field of wildlife biology. We will explore three different types of wildlife work: managing habitats or the places where animals live; managing populations or how many animals there are in an area; and researching wildlife.

2 People have always depended on wildlife for food, clothing, and shelter. For example, American Indians who lived in what currently is called the Midwest or the Plains used bison for food, shelter, clothing, games, and religious practices for thousands of years.

3 Today, people still rely on wildlife. Although some people still hunt wild animals for food, our greatest direct benefit from wildlife is enjoyment. Millions of dollars are spent every year to watch and photograph wildlife.

4 The first type of work wildlife biologists do is to keep wildlife species and their habitats healthy.

5 Habitat is the place where an animal lives and finds food, water, and shelter. A biologist can change the habitat in an area to make it more attractive for certain animals.

Fast Fact: Many wildlife professionals feel that habitat is the most important factor for managing wildlife populations.

7 For example, biologists sometimes use fire to change wildlife habitats. This is called prescribed fire and it's used to manage grassland, shrubland, and open woodland habitats.

6 Fire is a natural part of the environment. It is most often caused by lightning. If fires are not allowed to burn, plant communities can grow into unnatural and unhealthy conditions.

8 Some wildlife, like golden eagles, live in grasslands and open woodlands. If there are too many trees and shrubs, it is harder for them to catch jackrabbits and ground squirrels. Habitat biologists use fire to stop trees and shrubs from growing.

9 Fires do not burn evenly and leave patches of live trees. This mix of old and new habitat provides homes for different kinds of animals.

10 Black-backed woodpeckers benefit from forest fires because they eat the bark beetles that come to feed on the dying trees. These woodpeckers and other wildlife also nest or den in dead trees.

11 Another way biologists can improve wildlife habitat is through logging. By thinning a dense stand of trees, a forest can be made more attractive for some species.

21 Biologists can also improve habitats by limiting the activities that take place in them. Some species of animals are easily disturbed by human activities. Improving habitats can sometimes mean keeping people out of places needed most by wildlife.

22 Bat caves are sometimes closed to humans because some bats, such as the Townsend's big-eared bat, are very sensitive to human disturbance. If bats are disturbed during hibernation, they may use their last energy reserves to wake up—only to find no insects available—and then possibly die of starvation.

Environmental Education Programs

Fast Fact: Most female bats give birth to one pup per year and raise it with other mothers in a nursery colony. Bats are generally long-lived animals. Some live 30 or more years.

24 Another part of a wildlife biologist's job is to figure out the number of animals, or the population, in an area. Biologists don't have to count every single animal. However, they do need to know how many animals are born each year and if there are more or less animals each year.

25 Biologists gather information about wildlife to help make decisions about hunting seasons and the number of animals that can be taken each year.

27 When populations are too small, biologists may bring in animals from another healthier population. Of course, they first study the condition of the local habitat to be sure the animals will do well in their new home.

28 When populations are too large, wildlife can create problems for people. For example, beavers sometimes build dams that flood roads and people's property. Beavers can be trapped and relocated to areas where they won't cause problems for humans.

30 Wild animals may also cause problems by attacking livestock. They may then be trapped, taken to an area far from people, and released. If the same animal continues to feed on livestock, it may have to be destroyed or placed in a zoo.

Fast Fact: Different predators kill their prey in different ways. Biologists can often look at a carcass and tell what species was responsible.

31 Some wildlife species are in danger of becoming extinct because of human demands or damage to their habitats. "Extinct" means that there are none of that animal still living. Wildlife biologists try to keep animals from becoming extinct.

32 For example, biologists found that every year there were fewer northern spotted owls because too many trees in the forests where they live were being cut. Biologists continue to keep a careful watch on these owls to make sure they remain a part of our natural world.

34 Though habitat and population biologists have important jobs, researchers play an equally important role in wildlife management. Researchers find out what is needed to help wildlife survive and stay healthy.

35 Researchers study wildlife in many ways. One method is to individually mark animals so they can be identified if they are caught again. This Virginia rail has had an aluminum band with a unique number placed on its leg. If this bird is caught again by a researcher or found by any person, it can be traced back to the date and place it was originally captured. This can provide information about how far the animal traveled during that time.

36 Larger birds, like this swan, can be fitted with a wing tag. The large size of the tag allows a biologist to read it from a distance without ever catching the bird again.

37 Biologists can also tag animals with devices that transmit radio waves. Biologists use a receiver and antenna to locate the animal again. This gives biologists information about the movements of animals that are shy or secretive.

38 The field of wildlife biology has grown more complicated as knowledge of wildlife and the tools available become more sophisticated.

39 Not only do wildlife biologists need to know about the animals they work with, but they must know about plants, soils, water, and other parts of the environment.

40 They need training in biology, math, reading, and writing and they must be able to work with people as well.

42 We have learned that wildlife biologists have many different kinds of responsibilities.

43 Biologists manage habitat by helping provide places for wildlife to live.

44 They manage populations by keeping track of the number of animals in an area.

45 Biologists also use research to better understand wildlife and their habitats.

46 Many types of biologists spend their days "in the field," and by working together, these professionals keep both the wildlife and the places they live healthy for now and the future. If you are interested in wildlife, perhaps you will make the field of wildlife biology a part of your future.

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Presentation for Grades K-4

1 Today we are going to spend a day with a wildlife biologist. Wildlife biologists are scientists who work with wild animals. They often get to work outside or "in the field."

3 Wildlife is important to people. Some people hunt wildlife for food. Many people enjoy watching and taking pictures of wildlife.

15 Animals live in places where they can find food, water, and shelter. These places are called habitats. One part of a wildlife biologist's job is to keep habitats healthy so animals will want to live there.

5 One way to keep habitats healthy is with fire. Many fires are started by lightning. Sometimes biologists will use fire to get rid of plants that don't belong in the habitat.

8 Golden eagles live in open grassy areas. If there are too many trees and bushes, it is hard for the eagles to catch jackrabbits and ground squirrels. Fire can stop the trees and bushes from growing.

9 Though fires kill some trees, they also leave patches of live trees. Both kinds of trees provide homes for different kinds of animals.

10 Black-backed woodpeckers like dying trees because they can find bark beetles to eat and a place to nest in them.

11 Another way to improve habitats is through logging. Logging means cutting some trees down so they don't grow too closely together.

21 Wildlife habitats can also be improved by keeping people away from them. Many animals don't like to be too close to people.

22 For example, biologists may close a cave to people because it has bats in it. If someone disturbs a bat when it is hibernating, it may use all of its energy to wake up. When it can't find food, it may die of starvation.

24 Another part of the job for wildlife biologists is to figure out the number of animals—or the population—in an area. They want to know how many animals are born each year. They also want to know if there are more or less animals than in other years.

28 Too many animals in an area can sometimes create problems. For example, too many beavers can cause floods with their dams. The beavers then have to be trapped and moved to other areas.

30 Sometimes wild animals may create problems by attacking cattle and sheep. They may have to be trapped, moved to an area away from people, and released.

27 When the number of animals is too small, biologists may bring in healthy animals from other areas.

31 Some animals can be in danger of becoming extinct if their habitats are damaged. If an animal is extinct, it means there are no longer any of those animals still living.

32 Wildlife biologists try to keep animals from becoming extinct. For example, they found that every year there were fewer northern spotted owls. Too many trees in the forests where the owls live were being cut. Biologists are trying to improve this habitat so we don't lose these owls.

34 Another important job for a wildlife biologist is to study—or research—wildlife. This helps biologists find out what animals need to survive and stay healthy.

Environmental Education Programs

35 Researchers sometimes mark animals so they can track them and learn about their behavior. They may use leg bands with numbers on them, like the one on this Virginia rail.

36 They may also use wing tags on larger birds such as swans. Wing tags can be seen from further away.

37 Biologists also tag animals with devices that send radio waves back to them. This helps them learn more about animals that are shy.

39 Wildlife biologists not only need to know a lot about animals, they also need to know about plants, soil, water, and other parts of the environment.

40 They need to learn about biology, math, reading, and writing and how to work with people.

42 We have learned that wildlife biologists have many duties.

43 They help provide places for wildlife to live—this is habitat management.

44 They keep track of the number of animals in an area—this is population management.

45 They also study—or research—wildlife to better understand animal behaviors.

46 Many wildlife biologists spend their days in the field, keeping wildlife and the places they live healthy for now and the future.

Extension Activities

Introduction to Field Equipment (Grades K-4, 5-8, 9-12)

Objective: Students will learn about different equipment, supplies, and information that biologists use.

Materials: A variety of tools and supplies used by biologists, such as leg bands, wing tags, neck collars, telemetry equipment, megaphone callers, cameras, topographical maps and a compass, a bat detector, research reports, management technique manuals, field guides, data sheets, monitoring forms, binoculars, a scope and tripod, climbing equipment (rock and tree), wildlife tree signs, a drip torch, a Pulaski (axe), an increment borer, and a calculator. Create a nametag for each item.

Background: There are a variety of tools and supplies that wildlife biologists use to accomplish their work, from paper and pencil to technical devices. In addition, biologists need to have skills in math, science, reading, and writing. The equipment, supplies, and information that biologists have and display can be very stimulating to students and help them relate what they are currently learning to real life situations.

Method: Display your materials on one or two large tables. Keep the items covered until you are ready to show them. Consider both student safety and item sensitivity when establishing rules for handling the equipment. Talk about each item in turn. Include the name of the item and how it is commonly used. After all items have been presented, allow students to come to the table to handle the items and ask questions.

If time allows, let students actually use a few of the items. For example:

- place a few wing tags or neck collars at a distance and ask students to read them through binoculars or scopes (this can be done outside or from a window)
- place a transmitter outside and demonstrate how the signal changes as you get closer to or farther away from it
- use a topographic map to point out features visible from the school

The possibilities for such activities are limited only by your time and the equipment available.

Survey and Sampling (Grades 9-12)

Objective: Students will learn the importance of statistical sampling and the purpose and field application of wildlife surveys.

Materials: Calculator, paper and pencils, and four or more tape measures. This activity works best for classes with at least 20 students or members of the population to be sampled.

Background: Wildlife biologists often use mathematics during research, population management, and habitat management. It is impossible for biologists to check the condition of every habitat component or species population to help make management decisions. Biologists sample or observe a part of the situation or a portion of the population to gain their knowledge for developing management plans. Biologists often sample randomly to avoid collecting data that is biased. If decisions are based on too little information or on information that is biased, the outcome most likely will not accomplish management objectives.

Method: Explain to the students the importance of sampling, and the hazards of undersampling or basing perceptions on inaccurate information. Ask each student (without looking around the room) to guess what the average height of the students in the room is and write it down on a piece of paper. Then have the students give their answers to the regular classroom teacher and have the teacher tally the results (most- to least-often selected answers) and calculate the average height of the guesses.

Next, break the class into small groups and have each group conduct a study to determine the minimum, maximum, and average heights of the student population in the classroom. Assign each group a sampling rate for their study (25 percent, 50 percent, 75 percent, or 100 percent). Each sampling rate should be done at least once per study.

On a chalkboard or flip chart, review the results with the whole class. Compare students' personally observed answers with the results of the survey data. Discuss the differences between sampling intensities, looking at the accuracy of small sample size and the amount of work required to do a survey of the entire population. Also have students think of a few ways that this information could be used.

Prey Analysis: Dissecting Owl Pellets (Grades K-4, 5-8, 9-12)

Objective: Students will learn about one technique researchers use to study wildlife, specifically owls. Students will learn how to analyze owl pellets and how this method helps biologists learn about and manage for a specific species.

Materials: Owl pellets, tweezers, skull field guide (or a brief skull identification sheet), bone sorting chart, dissecting plates (such as paper plates), toothpicks, and small plastic bags (or construction paper and glue).*Also, field guides about mammals, birds, and owls could be useful for more detailed investigations.

Background: Studying wildlife species that are secretive, such as owls, can be difficult, especially if you are trying to see what they are eating. Owls provide us with a unique opportunity to learn what they feed on. Owls often eat their prey whole or in a couple of pieces that include fur and bones. The fur and bones cannot be digested and will not pass through their digestive system, but will be regurgitated, or coughed up, as a pellet.

By examining many owl pellets, we can determine what they feed on the most and therefore depend on for survival. It is important to know what owls eat because then we can also manage the habitat for their prey species.

Method: Give each student their own set of materials (or have them work in small groups). Have the students pick apart the pellets, separating the bones and skulls from the fur or feathers. Have them use a bone sorting chart to identify the different species and put together a whole skeleton. Also have the students determine how many different species were found in the class, as well as which species were eaten most often and least often.

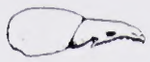
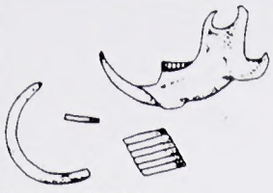
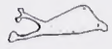
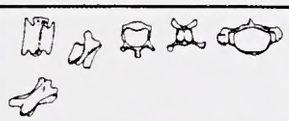
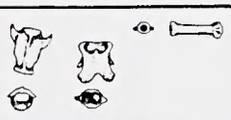
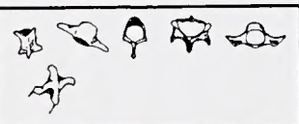
You may not know what species of owl produced the pellet, so you could have the students read about what different owls eat and come up with a short list of possible candidates.

One additional option is to have the students write a brief report of their findings about the species of prey and potential species of owl.

* Pellets can be collected in barns and near nests under trees where owls roost. Pellets and bone sorting charts are also available from various commercial sources.

Bone Sorting Chart *

Bone Sorting Chart

	RODENTS	SHREWS	MOLES	BIRDS
Skulls				
Jaws	 Loose Teeth			
Shoulder Blades				
Front legs				
Hips				
Hind Legs				
Assorted ribs				
Assorted vertebrae				

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* The bone sorting chart provided for this activity is used with permission from Pellets, Inc., of Bellingham, WA, 888-466-6957 (www.pelletsinc.com).

The ABC's Guide to Wildlife Biologists (Grades 9-12)

Objective: Students will demonstrate their knowledge of the field of wildlife biology by creating a storybook.

Materials: Construction paper for the book cover, white paper for the pages, colored pencils (markers, crayons, etc.), scissors, and a stapler. Also, the poster "Wildlife Biologists—A Day in the Field" may help stimulate ideas.

Background: This project is designed to show student comprehension of key concepts by having them "teach" these ideas to others through the creation of a children's book. The book can be turned in for assessment or passed on to elementary classrooms at the teacher's discretion.

Methods: Have students work in pairs and give each pair one or more letters of the alphabet until all letters have been assigned. Also, assign the task of creating the cover pages (title, illustration, and credits) to a pair of students.

Ask students to find a word that begins with their assigned letter(s) and pertains to the theme "wildlife biologists." Have the students draw a picture that depicts the word they have selected. Once the picture is designed, have each pair write a 50-word paragraph that describes their picture. (Students may want to first create a draft of their picture and description on a separate piece of paper and then transfer the final to the booklet page.) The student writers should determine the primary audience for the book and use appropriate vocabulary for the age group they are targeting. For example, the students may need to write so that an 8- to 9-year-old (third or fourth grader) can read and understand their book.

After all the students are finished, have them combine and arrange their pages alphabetically and staple the booklet together.

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Field Techniques (Grades 9-12)

Objective: Students will learn about the different field techniques, equipment, and resources biologists use.

Materials: Tables and a variety of tools and supplies that biologists use, such as a tape measure, leg bands, wings tags, neck collars, telemetry equipment, megaphone callers and tapes, remote camera sets, track plates, topographical maps and compasses, techniques manuals, field guides, identification keys, data sheets, binoculars, and a scope and tripod. Other possibilities might include skulls, tracks, and a Global Positioning System (GPS) unit. A data sheet could also be created for students to fill out as they go through each station.

Background: There are a variety of tools and resources that wildlife biologists use to accomplish their work, from basic field guides to technical devices. Biologists need to know how and when to use these tools, as well as have some basic skills in math, science, reading, and writing. The equipment, supplies, and information that biologists use and display can stimulate students and help them relate what they have learned to real life situations.

Method: Create four or more workstations for students to rotate through. This activity is best done outdoors and with the help of the teacher and a couple of volunteers. Establish a separate location for each workstation and prepare in advance, as much as possible, so you don't have students waiting. Explain the activity as a whole, the assignments for each workstation, and the order for rotating through the stations.

Break the students into small groups and have students work in pairs. Also, try to have enough workstations so there are no more than four to six students per group. Have students work at each station for a set time period (10 to 15 minutes), and upon your signal, have them change stations. Be sure that each station has someone that can help students understand the assignment and how to use the equipment.

Workstations are based on a theme, with two or more aspects for students to work on before changing stations. Following are some examples of workstations, but others could easily be substituted:

—Workstation No. 1—

Theme: Monitoring wildlife populations

Materials: Wing tags, neck collars, radio telemetry transmitter(s) and receiver(s), binoculars, and a scope and tripod.

Setup: Place wing tags or neck collars far enough away from the observation point so they cannot be read with the naked eye. Place the tags on the ground, on a branch, or on a stuffed animal to make it more interesting. Place one or more transmitters out a fair distance, in different locations and away from the wing tags and neck collars. Have the frequency already set on the receiver(s).

Activity: Briefly explain how to use the equipment. Have students locate and read the tag numbers using both the binoculars

and scope and then locate the direction for the transmitter(s) using the telemetry equipment. If time allows, students could also walk in on a transmitter.

Discussion points: Explore the tradeoffs of each technique.

—Workstation No. 2—

Theme: Conducting wildlife surveys

Materials: Remote camera(s), megaphone caller(s) and tape(s), track plates, and a field guide to animal tracks.

Setup: Organize materials by type so that students can set up mock survey stations.

Activity: Briefly explain how to use the equipment. List some species in the area from which the students could capture images and tracks. Then have students set up the camera(s) and track plates. For the megaphone caller, have the students play a few calls from a couple of different species.

Discussion points: Explore options of where the cameras and track plates could be placed outdoors to capture your target species. For the megaphone caller, talk about the problems when the volume is too loud or too soft.

—Workstation No. 3—

Theme: Orienteering and mapping

Materials: Table, long tape measure, compasses, topographical maps, and possibly local maps that include the school. It would be best to have several sets of compasses and maps so students could work in pairs. Additionally, a Global Positioning System (GPS) unit could be used in this exercise. However, you may only want to demonstrate how it is operated because it may be too complicated and time-consuming to teach students to use it.

Setup: Display the materials on a table.

Activity: Briefly explain how to use the equipment. Then have the students determine the direction the school and classroom are facing and the direction to their homes. To get a more precise reading, set up a mock situation. For example, describe a situation in which you need a photographic record of a specific area, called a photo plot. You need a reference point so that the photos are always taken from the same spot, and you need directions from the reference point to the photo plot. Then have the students get the bearing (compass direction) from the reference point to the photo plot and have them pace or use a tape measure to determine the distance.

Discussion points: Explore the importance of good orienteering skills and discuss why biologists use reference points instead of creating permanent markers for each photo plot.

—Workstation No. 4—

Theme: Using identification keys

Materials: Table, skulls, tracks, pressed plants, field guides, and identification keys.

Setup: Organize the materials to match up the specimens with the appropriate guide or key.

Environmental Education Programs

Activity: Briefly explain how to use the field guides and keys. Then have students work through the guides and keys to identify a couple of specimens. Guide the students as needed.

Discussion points: Introduce the concepts of diagnostic characteristics and the process of elimination. The focus should be on getting the students to narrow down their choices and not necessarily on getting to the exact genus and species.

Wildlife Biologist (Grades K-4)

Objective: Students will create a collage of a natural area.

Materials: Old magazines, scissors, glue sticks, paper.

Background: After hearing the presentation about the field of wildlife biology, students are given a chance to think of themselves in that role. This is a simple and creative activity that incorporates art and science.

Method: Review with the students the elements presented in the wildlife biologist presentation: biologists help make sure animals have proper places to live that provide the food, shelter, and water they need (habitat biologists); biologists monitor or keep track of the numbers of animals in an area (population biologists); biologists learn more about the animals they work with every day (research biologists).

Divide the students into groups of two or three and ask them to find and cut out pictures of items needed to create a healthy home or habitat for wildlife. Pictures should include at least plants, wildlife, and water and may also include any other natural elements including sun, sky, mountains, soil, etc. Have the students glue the pictures to a sheet of paper.

Tell each student that they are now in charge of the wildlife in their picture. The students should be able to explain what they might do (in simple terms) as a wildlife biologist. For example, the students may say that they are counting wildlife or studying birds or some other animal in the picture. Ask each group a question or two that will make them think a bit deeper about the topic ("How would you look for really small animals?" "How would you look for animals that are active at night?" "What might you as a biologist want to learn about birds?").

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Wildlife Biologists

A Day in the Field

The Wildlife Investigator Series

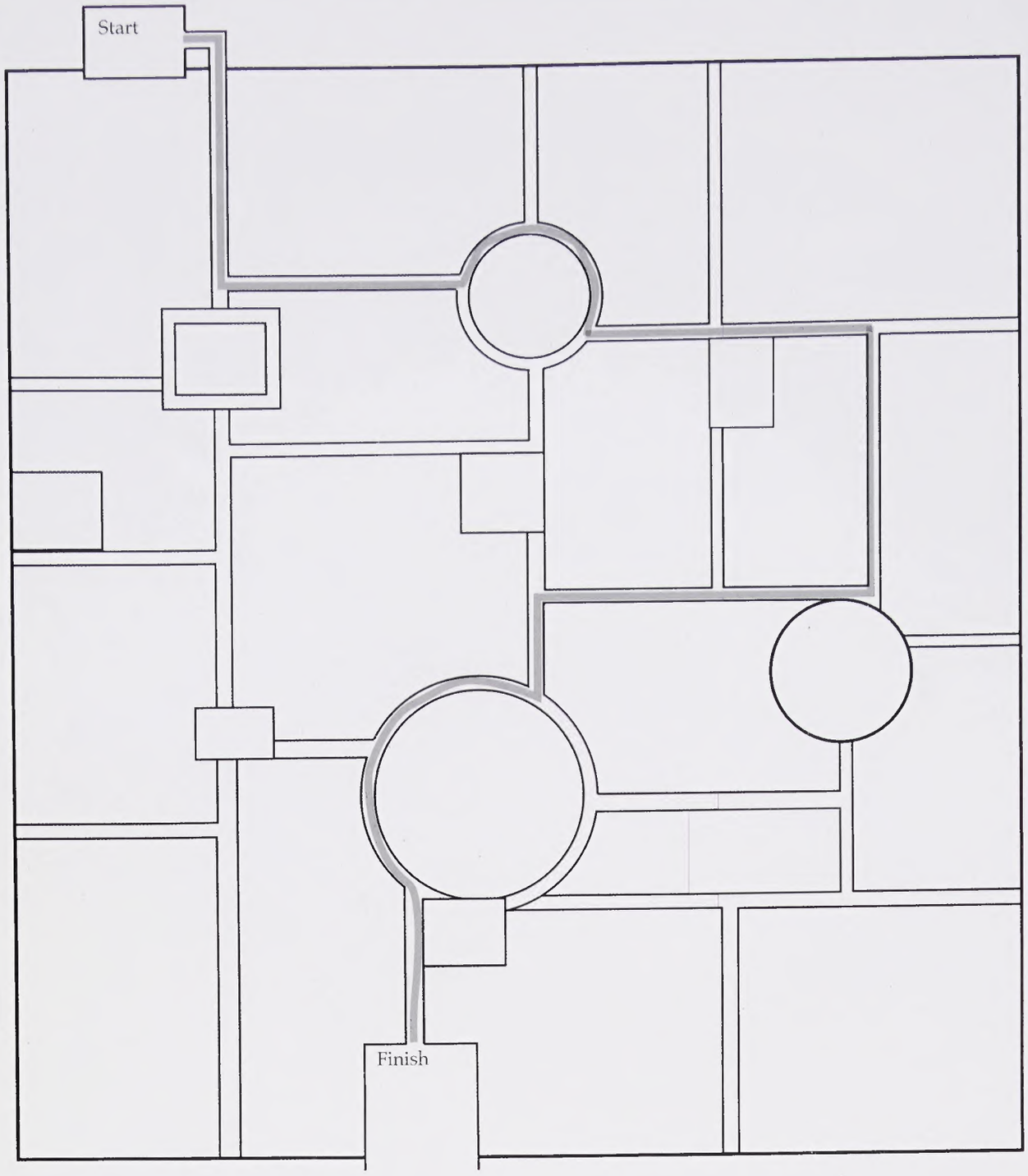
Environmental Education Programs

Explore the maze.
Help the mother lynx follow the green path through the pictures to find her way back to her kittens.

U.S. Department of the Interior
Bureau of Land Management

Photo Credits: W. Banaszewski, M. Burcham, W. Dean, W. Monroe, B. Schreiber, S. Sherman, J. Van Niel, W. Watkins

Poster and Poster Key



Wildlife Biologists Poster Key

The path through the maze is shown above.

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Slide Key

Overview of the Bureau of Land Management

1 Map of BLM lands
2 White Cliffs of the Missouri
3 Public land uses collage (BLM photos)
4 Kids in front of petroglyphs
5 Girl planting mangroves

Skulls, Antlers, and Horns

1 Title slide collage (photos by William Dean, BLM, and © John Van Niel)
2 Tyrannosaurus rex skull
3 Biologist measuring skull
4 Deer skull in leaves
5 Coyote skull
6 Great-horned owl skull
7 Great-horned owl
8 Beaver in water
9 Trees chewed by beaver
10 Beaver skull
11 Arctic ground squirrel
12 Desert cottontail
13 Rabbit skull
14 White-tailed deer skull
15 Mule deer
16 Elk in velvet
17 Elk velvet sloughing off
18 Elk rubbing antlers
19 Mule deer sparring
20 Dropped antler
21 Mountain goat
22 Bison Skull
23 Bighorn head-butt
24 Pronghorn
25 Wolf skull
26 Wolf yawning
27 Red fox
28 Red fox skull
29 Mountain lion
30 Bobcat
31 Lynx skull
32 Badger skull
33 Badger
34 Mink
35 Black bear skull
36 Black bears and coolers
37 Black bear licking tree
38 Raccoon skull
39 Raccoon
40 Skull characteristics
41 Plant eaters collage (photos © Justin Stevenson and © John Van Niel)
42 Horns and antlers collage (photo © Doug Driscoll and photo by William Dean, BLM)

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43 Meat eaters collage (photos © William Banaszewski and © John Van Niel)
44 Plant and meat eaters collage (photos © Milo Burcham, © William Banaszewski, and © John Van Niel)
45 Golden-mantled ground squirrel
46 Moose at sunset

Wildlife Trees

1 Title slide collage (photos © John Van Niel, © John Applegarth, © William Banaszewski, © Cory Mlodik, © Milo Burcham, © William Monroe, and © W. Steve Sherman)
2 Log cabin
3 Snag
4 Down log
5 Wood-boring beetle
6 Black-backed woodpecker in cavity
7 Hairy woodpecker
8 Northern flicker with tongue out
9 Blue bird at cavity
10 Screech owl in cavity
11 Great gray owl in broken tree top
12 Flying squirrel in cavity
13 Bat under bark
14 Black bear sitting in tree
15 Chipmunk with cheeks filled
16 Mice under log
17 American marten standing up against log
18 Lynx kits under log
19 Clouded salamander
20 Northern alligator lizard
21 Turtles on log in water
22 Pair of bald eagles in a snag
23 Flicker in a snag
24 Grouse drumming
25 Northern flicker in cavity
26 Sapsucker
27 Oozing sap
28 Bald eagle flying into nest
29 Black bear in tree
30 Logging truck
31 Wood cutter
32 Timber harvest unit
33 Tree blast
34 Blasted tree top
35 Tree topper
36 Osprey on nest platform
37 Swallow in nest box
38 Owl in nest box
39 Swallow in hand
40 Primary nesters collage (photos © Cory Mlodik, © William Banaszewski, and © W. Steve Sherman)
41 Secondary nesters collage (photos © William Monroe, © William Banaszewski, © Milo Burcham, © John Van Niel, and © W. Steve Sherman)
42 Down log users collage (photos © William Monroe, © Milo Burcham, © John Applegarth, and © W. Steve Sherman)
43 Special uses collage (photos © John Van Niel, © William Monroe, © W. Steve Sherman, and © William Banaszewski)
44 Great blue heron
45 Nest tree at sunset

Wildlife Biologists

1 Title slide collage (photos © John Van Niel and photos by Greg Miller, BLM, William Dean, BLM, and Frank Oliver, BLM)
2 Bison
3 Bison herd and viewers
4 Magpie on mule deer's back
5 Fire starter
6 Woodland burn
7 Heli-torch
8 Golden eagle with rabbit
9 Forest mosaic burn
10 Black-backed woodpecker on snag
11 Logging operation
12 Harvested unit
13 Tree topper
14 Osprey nest platform
15 Great blue heron
16 Wetland blasting
17 Wetland after blast
18 Wetland restoration

19 Cattle on creek bank
20 Yellow warbler at nest
21 Grizzly bear on road shoulder
22 Gated bat cave
23 Bull elk with cows
24 Cow elk with three calves
25 Game check station
26 Dead sheep
27 Sheep trap
28 Beaver trap
29 Sheep killed by grizzly
30 Grizzly bear trapped
31 Northern spotted owl
32 Harvested landscape
33 Bald eagles with young
34 Dall's sheep
35 Virginia rail
36 Trumpeter swan
37 Radiotelemetry
38 Biologists at nest platform
39 Lone biologist
40 Computer biologist
41 Field tour (public)
42 Biologists' activities collage (photos by Frank Oliver, BLM, William Dean, BLM, and © John Van Niel)
43 Habitat management collage (photos by Scott Cooke, BLM, Gavin Lovell, BLM, Greg Miller, BLM, Wedge Watkins, BLM, and © Milo Burcham and © W. Steve Sherman)
44 Population management collage (photos by Scott Cooke, BLM, William Dean, BLM, David Nelson, USDA, and © Milo Burcham and © William Banaszewski)
45 Research collage (photos © John Van Niel, © Milo Burcham, and © William Banaszewski)
46 Biologist with osprey

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